

BULBS

Bulletin of the International Bulb Society



Volume 6 No. 1

January – June 2004

Price \$5.00

TABLE OF CONTENTS

First Words	Tony Palmer	2
<i>Siphonochilus aethiopicus</i> – notes on an African Ginger Lily	Graham Duncan	4
The Genus <i>Cypella</i> and its closest relatives	Eric Walton	7
<i>Tecophilaea cyanocrocus</i>	Bill Dijk	12
The Elusive Fragrant Summer Flowering Gladiolus	Joan Wright	14
Seed Collecting in Africa	Rachel Saunders	18
A Synopsis of the Biosystematic Study of the Seven Minor Genera of the Hyacinthaceae	Alison Summerfield	24
Creating the Right Environment and Conditions for Cultivation	Gordon Summerfield	37
Book Review	Kathy Andersen	39

ADVERTISE IN BULBS!

ADVERTISERS: If you have a small nursery (or not so small) consider advertising in BULBS. Our readers have demonstrated their wish to support businesses that advertise in The International Bulb Society publications. Please contact Tony Palmer. Email to: adpal@ihug.co.nz

Ad Rates:	BLACK & WHITE		COLOR	
	once	Annual	once	Annual
¼ page	\$60	\$100/2	\$75	\$130/2
½ page	\$100	\$165/2	\$140	\$240/2
Full page	\$160	\$265/2	\$280	\$480/2

ADVERTISERS: If you would like to advertise your products or services in HERBERTIA, please contact Alan Meerow. Email to: prez@bulbsociety.org. Or call at 786-412-1821.

Ad Rates:	BLACK & WHITE	COLOR
¼ page	\$75	\$100
½ page	\$100	\$140
Full page	\$160	\$280

If you wish to run your ad in both publications, deduct 25% of the total from your order.

The opinions expressed by contributors in this publication are solely those of the individual writers and do not necessarily reflect the opinions of the editor, the board of directors, or of The International Bulb Society, Inc. (IBS). The IBS publishes paid advertisements as a service to its members but cannot be responsible for the quality of bulbs, geophytic plants, seeds, services, supplies, or other merchandise received, nor for guarantees expressed or implied.

The International Bulb Society, Inc., is a non-profit organization. Said corporation is organized exclusively for educational and scientific purposes; and especially to promote, encourage, and foster the horticulture, development, and improvement of bulbous or geophytic plants and public interest therein. These purposes are expressly limited so that IBS qualifies as an exempt organization under IRS code section 501 (c) (3).

Copyright 2004 International Bulb Society
All rights reserved

COVER PHOTO
Siphonochilus aethiopicus by Graham Duncan

I don't know if it is just my advancing age accompanied by some slowing down, but every year seems to be even more busy than the last. Looking forward a few years to when I retire, I can't see things changing very much apart from maybe not having nearly enough spending money. I am hoping to expand our mail order bulb nursery at that point, just as some of my contemporaries who have been running nurseries for a living all their lives are talking about quitting – and I'll believe that when I see it! The trick, rarely achieved, is to keep it all to a manageable size so that it doesn't become a burden. Wish me luck!

I am not alone in these thoughts of course. Most people complain about being too busy these days. We are therefore fortunate indeed that some of these busy people are still prepared to put pen to paper for our bulletin. This issue we have a major article by Alison Summerfield on her biosystematic study of the seven minor genera of the Hyacinthaceae. Many changes have been made and Alison helpfully includes a table of currently recognised species, together with their synonyms. She also provides keys as well as distribution and habitat information for the genera *Daubenya*, *Polyxena* and *Massonia*, and distribution information for *Whiteheadia*.

Alison's father Gordon Summerfield has written a complementary article on creating the right environment and conditions for the cultivation of South African winter rainfall bulbs and corms, with some very helpful tips and tricks.

I'm pleased to say I've finally been able to persuade Eric Walton to write us a comprehensive article on the South American genus *Cypella* and its closest relatives. I think you'll agree that it has been well worth the wait. His knowledge and love of his subject are both very obvious.

Another labour of love has been Joan Wright's lifelong plant breeding efforts, with the aim of producing a summer flowering gladiolus with a stronger fragrance than that found in the few softly scented gladioli then (in 1955) available from the USA. We share the tortuous and often frustrating journey to her goal. It is probably not surprising that few of us are serious plant breeders!

One of the nice things about this job is that every so often articles turn up out of the blue without my having had to indulge in any cajoling and nagging beforehand. One such in this issue is about a plant I

was not familiar with, namely the African ginger lily, *Siphonochilus aethiopicus*, and it is contributed by Graham Duncan of Kirstenbosch. He includes plenty of information on the cultivation and propagation of this delightful plant.

Love of the subject also applies to the shorter article this time. It is by Bill Dijk on his beloved Tecophilaeas, accompanied by some of his stunning photographs of them. Few can claim the success that Bill has growing and more importantly multiplying these little beauties.

Rachel Saunders gives a sometimes scary but often hilarious account of her seed collecting adventures with her husband Rod with some lovely pictures to illustrate it. I'll never look at those seed packets in quite the same way again!

We end with a review by Kathy Andersen of the book *Daffodils in Florida* a guide to which are the best types of daffodils to grow in warm climates.

LOOMING RESTRICTIONS ON THE INTERNATIONAL TRADE IN PLANT MATERIAL

Sadly the dark clouds of restrictions on the international trading of plants and seeds are gathering again. I have an e-mail from Joyce Fingerut of North American Rock Garden Society which I will share with you here and which outlines the current situation, future proposals and possible courses of action:

“ Organizations that mount international seed exchanges have recently found their efforts greatly hampered by the United States' decision, in January, 2002, to begin enforcing the requirement for a phytosanitary certificate to accompany all shipments of seed entering the U.S. This rule affected all US organizations with overseas members who donate seed, as well as organizations based outside the states with US members who request seed.

The North American Rock Garden Society (nargs.org) successfully led a petition to the United States Department of Agriculture (USDA) to eliminate this phyto requirement, in favor of requiring only an import permit (applied for and held by each US importer). This change in regulation should be completed within the next six months, and will greatly ease the burdens on all seed exchanges. But there are now far-reaching new changes being planned for the

US regulations governing the importation of nursery stock, including seeds.

These regulatory changes will affect not only those societies with US members, but all cross-national organizations, since we are finding that governments in many countries are likewise erecting regulatory barriers to imported plants and seeds, either as protection against the entry of pests, pathogens or invasive plants, or as retaliatory measures to the US restrictions.

Furthermore, new International Standards for the worldwide movement of plants and seeds are currently being formulated, under the aegis of the International Plant Protection Convention (IPPC), a part of the United Nations' Food and Agricultural Organization (FAO). These could have a chilling effect on the operation of any organization's seed exchange with members anywhere outside its own country.

In order to have a voice in these discussions and proposals, it would be very helpful to form an umbrella organization, composed of those societies whose memberships and seed exchanges cross national boundaries. I have found, through personal knowledge and online searches, that there are well over a hundred such organizations. The mere listing of their names, showing the broad extent of their reach, can be a powerful tool in working with government agencies.

Of course, no such list should be assembled without the assent of each of the societies. It would be productive to form a loose collaboration: a listing of like-minded organizations, or perhaps an online listserv for discussions of these questions. The backing of a confederation of over one hundred groups would bring considerable weight to bear at any governmental or international discussions. Our own government agency, in the USDA, has told me that such a body would enhance discussions with them; no doubt the same would be true in other countries, as well.

The North American Rock Garden Society is willing to be a part of such an overarching group. Would the International Bulb Society be interested in joining such an undertaking? All that is needed at the moment is an expression of your interest in exploring this idea, the name of a contact person representing the society, and suggestions as to the format this should take or topics of concern.

Thank you for your consideration of this new concept, as well as any ideas you may have to forward it. Joyce Fingerut Government Liaison, North American Rock Garden Society ”

Well there you have it. In an e-mail a few days later Joyce told me about a meeting happening at the moment of the North American Plant Protection Organization (under the UN's IPPC) which is writing

the latest draft of an international standard for the global movement of plants (and seeds and bulbs, of course). Their intention is to present a final Standard for comment and approval at the NAPPO annual meeting in October.

Joyce also wrote:....”on the US front, the proposed revisions for their plant import regulations (known as Q37) are on our Federal Register's website. Among other things, they are proposing a new classification for imported plants: excluded pending a pest risk assessment and approval. This should cause an enormous amount of mischief and hardship among the world's horticultural establishments and organizations. I believe that there will be a Stakeholders meeting at the USDA-APHIS headquarters in late May, and I hope to speak about the problems this new classification would cause. If this umbrella organization has begun to coalesce by then, I would be bringing a louder, clearer voice to the table. At present, over 40 societies have expressed positive interest.”

IN MEMORY OF JACK ELLIOTT

Jack Elliott was certainly a man who enriched many people's lives with his generosity in sharing seeds and bulbs with others worldwide before these restrictive regulations were more than a twinkle in bureaucrat's eyes. Sadly his own life came to an end in 2004 after a lengthy battle to recover from the effects of a stroke after heart surgery.

Although I never met him I felt I knew him well as a result of our contacts over the internet, and I was greatly looking forward to meeting him and his wife Jean on a trip they were planning to make to New Zealand, which I had helped him make the arrangements for. Tragically it was not to be.

I very much enjoyed our time together on the sub-committee for BULBS when Cathy Craig was Editor. It was a great privilege to work with someone of such great knowledge, friendliness and above all common sense. He was always able to use those qualities to calm things down if they got a bit heated, and he also came up with many practical suggestions that helped make BULBS what it is today. He is truly missed.

Siphonochilus aethiopicus

— NOTES ON AN AFRICAN GINGER LILY

Graham Duncan

PHOTOS BY THE AUTHOR

Several rampant Indian and southeast Asian members of the ginger family (Zingiberaceae) including the sweetly-scented white and yellow-flowered *Hedychium coronarium* and *H. flavescens*, respectively, have naturalised along water courses in South Africa and overwhelmed the indigenous vegetation in numerous temperate and subtropical



Siphonochilus aethiopicus

parts, and have been declared noxious weeds. However, few are aware that two members of this family of 53 genera and well over a thousand species from the tropics and subtropics occur naturally in southern Africa. They belong to the genus *Siphonochilus* that comprises some 20 species endemic to Africa, and were previously included under *Kaempferia*. *Siphonochilus aethiopicus*, commonly known as Natal ginger, occurs in the South African provinces of Limpopo and Mpumalanga, and in Swaziland. It also used to occur in the province of KwaZulu-Natal in eastern South Africa. Its distribution extends further north over a vast area of tropical Africa to the northeastern and western parts of the continent. It is highly valued for its medicinal and magical properties by the indigenous peoples in the eastern and northern parts of southern Africa, and holds large, as yet untapped potential in ornamental horticulture. The closely related *S. kirkii* has an entirely tropical

distribution extending from the Caprivi Strip in the far northeastern part of Namibia, northeastwards to east Africa.

The subterranean storage organ in *S. aethiopicus* is a series of cone-shaped rhizomes tightly packed together, producing strong fibrous roots that form elongate, tuber-like swellings towards their tips. The rhizomes emit a pungent spicy aroma and it is this portion of the plant for which a seemingly insatiable demand exists in regional ethnomedicine. Its plethora of medicinal applications include relief from malaria, coughs and colds, rheumatism, toothache and neuralgia, while its magical attributes are focused primarily on protection from lightning and evil spirits. The bright green, lance-shaped foliage is borne alternately along an erect, narrow pseudo stem reaching up to 60 cm high.

The leaves of *S. aethiopicus* are partially hysteranthous, emerging directly after flowering commences, or simultaneously with the flowers, once sustained hot weather sets in from early November to mid-December in the Southern Hemisphere. Inflorescences are only produced from the current season's growth and consist of two to ten flowers. Several inflorescences may be produced by the same rhizome, and although individual blooms last just one day, a succession of flowers is produced over a period of two to three weeks. Large established clumps afford a really spectacular display. While the narrowly lance-shaped petals are translucent white and somewhat inconspicuous, the flower is dominated by an extraordinary lavish lip that is quite startling in its pinkish-mauve hues, with a prominent deep yellow band in the centre. The flowers have an almost hypnotic effect and one finds oneself gazing at the spectacle for inordinately long periods of time! Borne at ground level, they have subterranean ovaries and are heavily sweet-scented (reminiscent of *Gladiolus orchidiflorus*), especially in the early morning and at dusk. Another unusual feature of this species is the occurrence of hermaphrodite (bisexual) and somewhat less showy female flowers. Certain clones only produce

hermaphrodite flowers (such as those under cultivation at Kirstenbosch), while others produce both hermaphrodite and female flowers from the same plant, on separate inflorescences.

Although *S. aethiopicus* is firmly established in small scale commercial cultivation in South Africa for the purposes of medicinal trade, attempts at introducing it into general horticulture here appear to have been met with limited success, probably due to a lack of awareness among the gardening public as to its ease of cultivation, and difficulty in obtaining propagative material.

Successful cultivation of the plant presents no great difficulty, but bringing it to flowering stage has been somewhat problematic in that optimum conditions for flowering have not been clearly understood, stemming mainly from the erroneous belief that the plants require shaded conditions. For many years, a



Hermaphrodite clone of *Siphonochilus aethiopicus* flowering in the Kirstenbosch bulb nursery

large stock of mature *S. aethiopicus* plants propagated by tissue culture were maintained in the Kirstenbosch bulb nursery in deep raised beds, under what were considered to be ideal, shaded to partially shaded conditions, yet they steadfastly refused to flower. Then several years ago, the old fibreglass bulb house roofs were removed, fortuitously in late October, as part of the phased erection of new nursery facilities. This effectively exposed the bed of dormant ginger lilies to full sun for the first time. Subsequently, within a matter

of days of receiving their first heavy drenching, and much to my surprise and delight, several plants burst into flower.

During the early 1980's, several hermaphrodite clones of the plant were obtained by horticulturist *extraordinaire* Geoff Nichols, formerly of the Durban Park's Department, South Africa, from various sources in KwaZulu-Natal, and were propagated at the Department's Silverglen Medicinal Plant Nursery. Thousands of plants have subsequently been produced from the Silverglen nursery and established in commercial cultivation all over KwaZulu-Natal for purposes of the herbal trade. Material of one of these clones was also provided to the erstwhile Laboratory for Endangered Plants at Kirstenbosch, where Dr Hannes de Lange succeeded in establishing the species in tissue culture and making plants available to the public. It is material of this clone that is currently being grown in the Kirstenbosch bulb nursery.

In their excellent treatise of *S. aethiopicus* in the most recent edition of *Flowering Plants of Africa* (Volume 58, 2003), Dr Neil Crouch, Prof. Gideon Smith and Gillian Condry confirmed earlier reports that the species had not been found in the wild in KwaZulu-Natal for more than 80 years. Accordingly they consider it extinct in nature in that province as a direct result of over-exploitation for the medicinal plant trade. The authors further state that although the plant still survives in very limited numbers in Limpopo, Mpumalanga and Swaziland, 65% of the remaining sites fall outside the boundaries of nature reserves, and are thus at continued high risk of exploitation. Its current conservation status is not surprisingly categorised as 'critically endangered'.

The most notable causes of habitat destruction of *S. aethiopicus* in the northern provinces of South Africa have been large scale commercial forestry activity and agricultural extension, but the continued harvesting of rhizomes from the wild for the muthi trade has had by far the greatest impact on population numbers in the wild (Crouch et al., in *Herbertia* 55, 2000).

Cultivation

Natal ginger lilies are easily maintained under cultivation provided certain conditions are met. The plants are tender, deciduous and strictly summer-growing, and should ideally have a completely dry winter rest period. The preferred growing medium is a slightly acid one with high humus content and excellent drainage, such as three parts well decomposed compost and one part coarse river sand. The rhizomes should not be planted too deep and should ideally rest 2–3 cm below soil level. The plants perform very well in deep

raised beds and are also well suited to rock garden pockets, as subjects for large containers, or placed towards the front of the herbaceous border. In cold climates of the Northern Hemisphere they are most suitably grown in a heated greenhouse. It should be borne in mind that the plants have a vigorous root system and when grown in containers, need to be re-potted every other year, failing which flowering performance diminishes and finally ceases. Deep plastic pots with a diameter of 25 cm are suitable for plunging into garden beds in spring in winter rainfall areas, and can then simply be lifted in late autumn and stored dry over the winter period. Larger pots with a diameter of 30–35 cm are recommended when grown as specimen plants. When grown under shaded or partially shaded conditions, luxuriant foliage is produced, but for successful flowering to take place, a minimum of full morning sun or very bright light for as much of the day as possible is required. Where shaded to semi-shaded conditions prevail, the foliage of this plant can also be put to good use, providing welcome contrast to other shade-loving foliage plants.

Natal ginger lilies benefit from regular heavy drenching at least once a week, applied from early summer to late autumn. They are gross feeders and respond very well to supplementary fertilisers applied either in liquid or pellet form; the application of the non-burning, non-toxic organic pellet fertiliser Neutrog Bounce Back delivers excellent results. Towards late autumn the foliage begins to die back, and watering should then be withheld for the duration of the winter months, during which time they are best kept as dry as possible, but remaining in soil to prevent desiccation of the swollen root tips. As an experiment, several potted, plunged specimens of *S. aethiopicus* that were displayed in the newly developed 'Garden of Extinction' at Kirstenbosch over the 2003/2004 summer period, were purposefully left in their plunged positions for the duration of the winter months in order to test their reaction to winter rains during dormancy. Although the rhizomes easily survived the wet and cold conditions, they have failed to flower so far this summer, and vegetative growth has been significantly delayed when compared with that of the nursery stock that experienced a dry, relatively warm winter.

Propagation

For the home gardener, increasing stocks of *S. aethiopicus* is most conveniently achieved by separation of thick rhizome clumps towards the end of the winter rest period, or up until late spring, just before flowering and leaf growth commences in early summer. Ensure that separated clumps each have a strong growing point and replant them immediately in order to prevent

excessive desiccation of the roots. As the plants multiply rapidly under ideal conditions, allow sufficient spacing of about 30 cm around each clump. Propagation by seed is problematic in that the seeds develop and mature below ground level, and are thus not easily found. Even when seeds can be located, germination is erratic and according to Geoff Nichols, can take up to one year. For large scale production, plants are most successfully raised by means of tissue culture.

At Kirstenbosch mature plants have proved to be generally pest and disease-free, the only troublesome encounters to date being with small grey snout beetles, whose nocturnal forays result in unsightly brown marks on upper leaf surfaces and along leaf margins. Snout beetles chew the leaves of a range of summer-growing and evergreen bulbous genera in southern Africa, including *Clivia*, *Crinum* and *Nerine*. The culprits are only active at night, hiding between the leaf bases during the day, and are exceptionally sensitive to vibration, dropping to the ground within split seconds where they become instantly camouflaged. Fossicking around the leaf bases by day when they are inactive yields a certain number of them but inevitably one misses a few and the damage caused by just one individual can be severe. Catching them the environmentally friendly way by torchlight at night is best achieved by carefully placing a large bowl underneath the leaves, then shaking them off and crushing their hard exteriors by hand. In severe infestations, spraying with a cypermethrin-based insecticide such as Garden Ripcord is highly effective. Fungal rotting of the rootstocks is common where the soil medium remains excessively wet for long periods over the winter dormant months.

References:

Crouch, N.R., Smith, G.F. and Condry, G. 2003.

Siphonochilus aethiopicus.

Flowering Plants of Africa 58: 56-68.

Nichols, G.R. 1989.

Some notes on the cultivation of Natal ginger (*Siphonochilus aethiopicus*).

Veld & Flora 75 (3): 92-93.

Watt, J.M. and Breyer-Brandwijk, M.G. 1962.

The medicinal and poisonous plants of southern and eastern Africa. Livingstone publishers, Edinburgh.

Crouch, N.R., Lötter, M.C., Krynauw, S and Pottas-Bircher, C. 2000

Siphonochilus aethiopicus (Zingiberaceae), the Prized Indungulu of the Zulu – an Overview
Herbertia 55: 115-129.

The Genus *Cypella* & its closest relatives

Dr. Eric Walton

ALL PHOTOS BY THE AUTHOR

Quite a number of South American Iridaceae can be grown readily outside in the region of New Zealand where I used to live. Of the South American Iridaceae, the species with particular appeal to me are those in the genus *Cypella* and its close relatives. There is some debate among taxonomists as to the boundaries of many of the South America Iridaceae genera, and in this article I will also discuss the species that are, or have been (depending whether you follow the taxonomic lumpers or the splitters) in the genera *Hesperoxiphion*, *Larentia* and *Phalocallis*. In total, these genera comprise something like 25 species.



Cypella herbertii

The name *Cypella* comes from the Greek for ‘cup’ and refers to the shape of the flowers. Members of the genus have bulbous rootstocks, plicate (pleated) leaves and flowers with three spreading outer tepals (the large ‘petals’) and three folded inner tepals.

The most commonly grown *Cypella* in New Zealand is *Cypella herbertii*. It is also the most

widespread species being indigenous to Brazil, Paraguay, Uruguay and Argentina. The leaves are approximately 20 cm long, but the plant grows to about 45 to 60 cm high when in flower. The outer tepals are a rusty orange colour with a dark brown stripe down the middle of each. The inner tepals are similar in colour to the outer tepals, but with a white stripe down the centre and brown flecks joining the orange and white bands. The flowers only last one day, but a well-grown clump will produce several hundred flowers over the summer and so is quite showy in its own quiet way. The specific name refers to Dean William Herbert, the renowned bulb

taxonomist in Britain in the early 1800s.

There is a subspecies of this plant grown in New Zealand, namely *C. herbertii* ssp.

brevicristata, which is a much smaller plant, growing to perhaps only half the height of the type. The other major differences are that the flowers are canary-yellow and do not have the brown stripe down the centre of the outer tepals. I understand there is an opinion that this plant should be considered a species in its own right rather than a subspecies of *C. herbertii*.

There are a number of other species grown with flowers similar in form to *C. herbertii* and these include *C. armosa*, *C. fucata* and *C. osteniana*. Under my conditions, these species are similar in height to *C. herbertii* ssp. *brevicristata*. *C. armosa* is indigenous to Argentina and the flowers are pale lemon yellow in colour and are distinct in that the outer tepals hang nearly vertically. *C. armosa* gets its specific name from the rather long style-arms that are the

extensions to the style. The flowers of *C. fucata* are very similar in colour to those of *C. herbertii*, but are of a slightly darker and more intense shade. It also has long style-arms and in that respect is not dissimilar to *C. armosa*. The specific name *fucata* means ‘painted’ and I assume this refers to the faint dark lines on the outer tepals. This species is



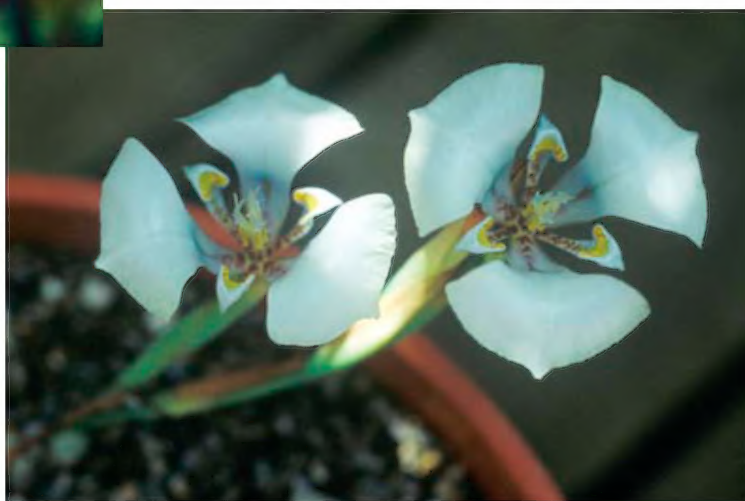
Cypella armosa

indigenous to Brazil and north-eastern Uruguay. *C. osteniana* has very beautiful creamy-white flowers with a buff or pale-brown shading. In addition, the inner tepals are marked with black and yellow making it one of the most beautiful species I have grown. It is indigenous to Uruguay. *C. armosa*, *C. fucata* and *C. osteniana* all have limited distributions in the wild and are all threatened by human activity, but unfortunately I believe *C. fucata* is near extinction. I have another species in my collection that is supposed to be *C. laxa*, a plant indigenous to Brazil, but I am uncertain of its identification. The plant is similar in size to *C. armosa* and the flowers are yellow, a shade about half way between those of *C. herbertii* var. *brevicristata* and *C. armosa*. The flowers also have a few spots at the base of each tepal.

All these species are easily grown in well draining soil or in pots in full sun. They are semi-evergreen, in that they never go fully dormant nor do they lose all their leaves in winter. These species are quite hardy in the garden I had in the Waikato (which is just south of Auckland), even when grown in pots. In fact, I suspect the plants require a certain amount of cold during winter to flower well the following spring and summer. I should say more about the Waikato climate – it is what should be called warm temperate with warm, not hot summers and cool, not cold winters. Frosts were not uncommon in winter but tended not to be very severe and were of relatively short duration.

Another species I grew was *C. hauthalii* ssp. *opalina*, a dwarf plant only growing to about 10 cm in height. The flowers are creamy-white and the outer tepals have an opalescent lustre, which is reflected in the subspecific name. The culture of this plant is similar to the previously mentioned species, but I believe this plant requires a little more warmth during winter to do well. The plant is indigenous to Argentina.

Quite different again is *C. aquatilis*. As the specific name suggests this plant grows under very wet conditions on the sides of streams and is indigenous to Brazil. The flower colour is what could be described as a somewhat burnished golden yellow and they are much larger than any of the fore mentioned species, but also have proportionally larger ‘cups’. This species is also unusual in that after flowering, the inflorescence



Cypella hauthalii ssp. *opalina*

stems produce bulbils at most axils. These are a useful way to propagate this plant, as the clone I have has never set seed. This plant should be grown in a moderately large container as it is a rather vigorous species and can multiply rapidly. The container should be stood in a deep saucer (say, up to half the depth of the container) and this should be kept continually filled with water if you want your plants to do well. Under my conditions, this plant flowers over several weeks in early summer.

The second most commonly grown *Cypella* in New Zealand is *C. coelestis*. It should be noted that this plant has gone through numerous name changes and ‘misidentifications’, but I believe it is currently ‘resting’ in *Cypella*. However, if you follow the taxonomic splitters, and recognise the genus *Phalocallis* (means shining or bright beauty), the plant would be known as *P. coelestis*. As I understand it, the debate revolves around the degree of



Cypella coelestis

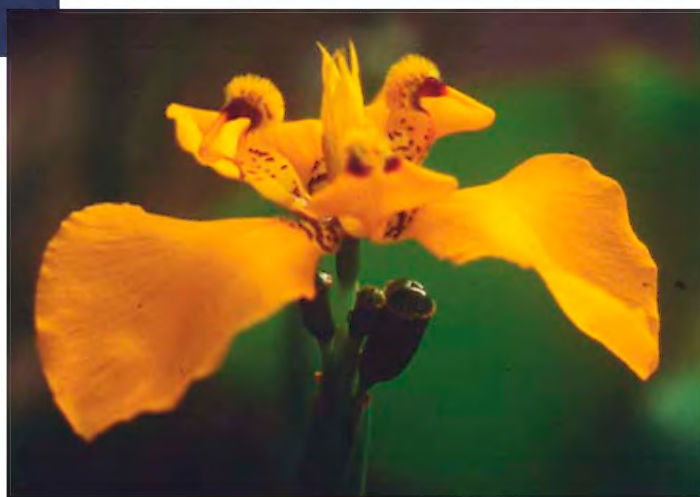
importance placed on flower form and inflorescence morphology. The plant was, until relatively recently, known as *C. plumbea*, but is often distributed in New Zealand as *Herbertia platensis*, a name of no standing. *Herbertia* is a taxonomically valid genus of plants related to *Cypella*. One of the main differences is that the inner tepals of *Herbertia* are reduced to small tongue-shaped structures that curl under them. Another generic name that crops up from time to time for this plant is *Alophia* (which is also often confused with the true *Herbertia*!), but *Alophia* is a different genus again, which is also taxonomically valid. It is characterised by, in part, the shape of the anthers, which are lyrate or fiddle-shaped.

Cypella coelestis grows taller than *C. herbertii*, to about 75 to 100 cm and the leaves are larger and, what I can best describe as, 'more coarse'. The outer tepals are pale-blue (*coelestis* means sky-blue) and the inner tepals are pale-yellow and white. At the bases of both the inner and outer tepals there is banding, rusty-red in colour. The plant is semi-evergreen and flowers in mid summer. It readily sets seed – so much so that it used to pop up all over my garden. It was never weedy and you always had plants to give away without disturbing the main clump! A point to note – the seed of *C. coelestis* are a lot larger than the other *Cypella* species I grow, being up to 3 to 4 mm in length and not as hard. The bulbs are also curiously different in that they are a bright rusty-red colour.

Another group of 'cypella' are those species in the genus *Hesperoxiphion*, which I believe is currently recognised, so I will use that here. Taxonomically,

Hesperoxiphion are different to *Cypella* in that the inner tepals have a single pubescent (finely-hairy) band and different inflorescence morphology. The species I grow are also 'horticulturally different' to other species I grow in that they go completely dormant in winter and the bulbs are deciduous. Under Waikato conditions, the first frosts of winter cut back the foliage and the bulbs remain dormant until the temperatures warm in the following spring. The origin of *Hesperoxiphion* is rather interesting as *hespero* means western and *xiphium* means sword, which was the Greek name for a gladiolus.

Hesperoxiphion peruvianum (or *Cypella peruviana*) is probably the most commonly grown



Hesperoxiphion peruvianum

species in the genus and, as the specific name implies, is indigenous to Peru. It is a very beautiful and desirable plant and is one of the most favoured iridaceous plants I grow. I have two forms, one with yellow flowers collected from near Puno, and the other with orange-yellow flowers collected near Machu Picchu. Each bulb produces an abundance of flowers in late summer. The Machu Picchu form is more robust, and infinitely more desirable, having flowers approximately 10 cm in diameter on well-grown specimens, which have a very strong, almost overpowering scent similar to *Freesia*. Unfortunately, this is only on hearsay – I cannot smell them! Many visitors to my garden are given the 'sniff' test to see if they can smell *H. peruvianum*. Curiously, in my limited test, people who cannot smell it can smell *Tigridia van Houttei* – a plant with fetid, musty smelling flowers similar to *Lilium pyrenaicum* – but not both! Sad, but true, I can only smell the *Tigridia*! *H. peruvianum* readily sets seed, but also offsets rapidly. I used to grow my bulbs of this species in black plastic pots, the idea being that the soil would

warm more rapidly in the spring and the bulbs come into growth sooner. This ensured that a high number of flowers are produced before the first frosts. However, now that I have many more bulbs, I also grow them in the ground and they do even better – there are more flowers and they multiply even faster!

An interesting point to note is that a large clump of say 50 individual *H. peruvianum* bulbs will flower synchronously every second or third day through the flowering season. I suspect that this response may be mediated by the gaseous plant growth regulator ethylene. Synchronicity is only lost as the temperatures cool as the autumn approaches.

H. peruvianum, being from the high Andes, is quite hardy in the Waikato and bulbs may be left in the ground year round in well draining soils. Bulbs can also be dug and stored dry, as can be done with tulips and daffodils, and this approach may be useful for people in climates with very cold winters. However, I have found some dry potting mix around the bulbs while in storage stops excessive desiccation and this is better in the long run.

A word of warning for everyone, but particularly for those readers who live in New Zealand, is that the bulbs of *H. peruvianum* are very tasty to our native bird, the pukeko (swamp hen or purple gallinule, *Porphyrio porphyrio*). They will start at one end of a row, and in short order, will lift each bulb and eat it. The foliage is left behind tidily windrowed!

I also grow *H. niveum* and *H. herrerae*, both of which are indigenous to Peru. This former species is also very beautiful, with vivid white flowers, the colour of which gives this plant its specific name. It is only about half the height of *H. peruvianum* but is as



Cypella herbertii var. *brevicristata*

easy to grow. The flowers of *H. herrerae* are royal blue and quite beautiful. I haven't been as successful with this species – I suspect it may be a tad fussier. I have another *Hesperoxiphion* of uncertain identity. It has a flower very similar to *H.*

peruvianum in size and form, but the colour is a yellowish tan and the plant is quite short – less than the height of *H. niveum*. If anyone knows the true identity of this plant, please get in touch with me. I was once given a bulb of *H. huilense*, a white flowered species in this group from Colombia, which is supposed to be semi-evergreen.

Unfortunately, the bulb was delayed in the post during the

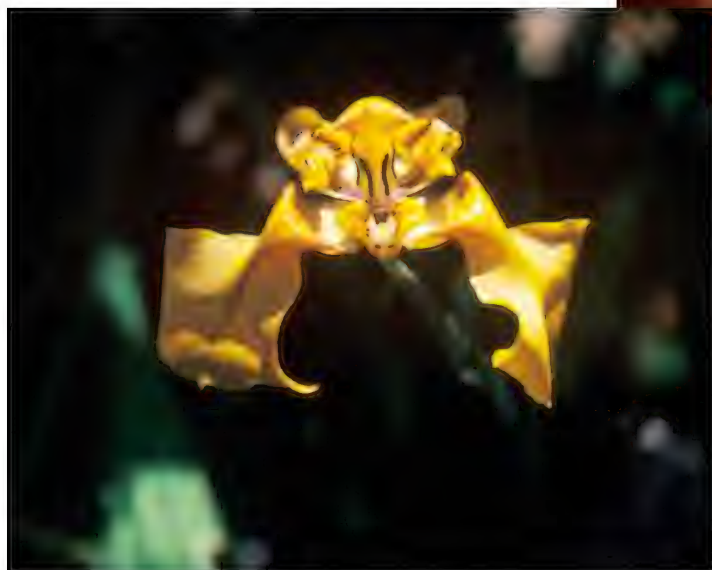
Christmas holiday period and rotted on planting. I was also sent seed of this from the same source but these on flowering were *Gelasine azurea*, now known as *G. coerulea*. I'm sure I am not the only one who has received seed of a much coveted treasure to find after several years of cossetting, that on flowering it is not what one had dreamed of!

The fourth and last genus in the *Cypella* group that I will discuss is *Larentia*. I am uncertain of the taxonomic status of this genus – whether it is in vogue or not. However, I understand it is comprised of two species, namely *L. rosei* and *L. linearis*. The former species has pale blue flowers and the latter has dark blue flowers. These are tropical species from low elevations in Mexico from areas that are seasonally wet. I have purchased seed of *L. rosei* several times and had good germination and that was about it! I am uncertain whether I should have kept them wetter or hotter or both. I suspect that they are likely to require warm greenhouses to perform well anywhere in New Zealand. However, I would welcome to be proved wrong!

A few final thoughts, which hopefully do not sound trite! All species that I have grown respond well to regular applications of fertiliser. The better the plant is grown the more flowers are produced. If the plants are kept well watered, flowering will continue into the summer for *C. armosa*, *C. fucata*, *C. herbertii* and *C. osteniana*. Sometimes if a watering is missed the plants will temporarily stop flowering, but will resume when watered again if the break is not too long. The bulbs should not be allowed to dry out when being transplanted with the exception of those species in the genus *Hesperoxiphion*. I believe the time out of the



Cypella osteniana



Cypella fucata

ground should be kept to a minimum, because of the never really dormant nature of most species.

If only a few bulbs are required, the easiest way to propagate *Cypella* is by division of an existing clump. For the semi-evergreen species, under my conditions, I believe this is best done in autumn, just prior to the flush of growth that comes with the autumnal rains. This also allows the bulbs to re-establish well prior to the main flowering period in the spring. In very cold districts it may be better to wait until spring. The exceptions to this are *C. hauthalii* ssp. *opalina* and the members of the genus *Hesperoxiphion* because of their different growth cycles. The former should be divided in late summer and the latter should be divided in spring, prior to the recommencement of growth in both species.

Alternately, or to produce large numbers of bulbs, the plants are easily propagated from seed. In my experience, the seed should be sown as soon as ripe in a very freely draining, gritty potting mix. The seed may take some time to germinate, particularly if old. In the past I have kept pots for two or three

years in the hope something might appear, particularly if it is rare. Now, I chit all the seed (carefully cutting off the corner of the seed with a scalpel, aiding the entrance of water into the seed) and sow in warm conditions (say 20 – 25 °C) until something germinates. I have a feeling that a period of chilling temperatures to imbibed seed may be beneficial for the germination of *Hesperoxiphion peruvianum* but I have never really put this to the test.

The biggest problem in growing rare and unusual bulbs is acquiring the plant in the first place. Good luck with that and good luck when you find them – they are beautiful and interesting plants to grow!

Eric Walton is a plant physiologist in New Zealand whose current research is focused on identifying genes that control dormancy in kiwifruit. He has been growing plants for nearly as long as he can remember and has been a member of the International Bulb Society, and its antecedent organisation, since 1979. In addition to bulbous plants, his current garden is planted with a subtropical theme and contains a wide range of other plants, including palms, cycads, aroids, ginger, bromeliads, ferns, bananas and Marantaceae that perform well in the Auckland climate.

The Joys of Growing *Tecophilaea cyanocrocus*

By Bill Dijk

ALL PHOTOS BY THE AUTHOR

When it's the flowering season of my pet subject I get all excited, and have been known to go into uncontrollable raptures of delight and reverence! I am of course talking about the winter-flowering *Tecophilaea cyanocrocus* and its varieties.

A cold climate, hardy bulb for the keen grower and collector and without doubt the most sought after of all the smaller flowering bulbs – the fabulous Chilean Blue Crocus. They are now believed to be critically endangered in the wild, mainly because of over-collecting and intensive grazing by cattle and sheep to the point of becoming extinct.

Fortunately they are not difficult to grow, and, although rare in cultivation, given the right environment they will not be lost from the planet. Their supreme beauty and rarity make them a must in every connoisseur's collection.

They are usually grown in an alpine house or cold glasshouse and because they are so unique and

beautiful, these plants justify such special attention and treatment. Plant the bulbs in a well drained fertile potting mix 5 centimetres (2 inches) deep. They should remain cool until growth appears from mid to late winter. They start growth early in the season, but appear to be hardy in all but very exposed areas. Young growth can be scorched with severe frost, but will soon harden. They need very good drainage.

Water only when in growth, but be careful not to over-water in warm humid conditions. When flowering is finished, gradually reduce water to allow bulbs to go dormant and dry in summer.

In view of their small size and rarity *T. cyanocrocus* species are best cultivated in a container or some other "protected" situation where they can thrive and receive the special attention they deserve. A pot of them is always treasured by keen collectors.

Bulbs multiply slowly; the best method of

increase is to propagate from fresh seed, sown in autumn in a gritty seed mix. Seed will develop more readily when hand



A collection of
*Tecophilaea
cyanocrocus*
and its varieties

pollinated, which requires a deft, delicate touch with a very fine camel-hair brush if it's going to be successful. I sow seeds in April-May (Southern Hemisphere) in a well-drained seed medium in deep seed trays, with plenty of coarse sand and/ or pumice for good drainage and topped off with ½ inch of finer mix or river sand. The seed normally germinates in 6 to 8 weeks and seedlings will reach flowering size when grown on for another 3–4 years.

Tecophilaea cyanocrocus:

one, often two flowers are produced per stem. They are an intense vivid gentian blue with a white throat. Flowers are 5 centimetres (2 inches) across when fully open.

***T. cyanocrocus*, var. *leichtlinii*:**

the same beautiful plant with 5 centimetre (2 inch) sky-blue flowers and large white centres.

***T. cyanocrocus* var. *violacea*:**

an attractive but rare variety, whose bright violet blue flowers have great charm.

Tecophilaeas are always much admired and when flowering en masse are a sight never to be forgotten.

Bill Dijk lives and grows in Tauranga, New Zealand, zone 8-9.



Tecophilaea cyanocrocus



Tecophilaea cyanocrocus leichtlinii



Tecophilaea cyanocrocus
var. *violacea*

The Elusive Fragrant Summer Flowering Gladiolus

Joan Wright

ALL PHOTOS SUPPLIED
BY THE AUTHOR

In 1955, I started work to try to produce a summer flowering gladiolus with a stronger fragrance than that found in the few softly scented gladioli then available from the USA. Those had no fragrant species in their ancestry, but may have been carrying the trait recessively.

MATERIAL USED

- 1 The strongly scented *Acidanthera bicolor* var. *murielae* which has now been re-classified as a *Gladiolus* species – *G. callianthus* var. *murielae*
- 2 Several small flowered *Gladiolus* cultivars strong in desirable traits that were lacking in *G. callianthus* var. *murielae*

The latter had only 3-4 florets that were white with dark blotches on petal bases and throat and were suspended by long styles, well clear of the flexible flower spikes. Because of this pendulous kind of attachment, the florets tended to face downwards, but as it was the only fragrant summer flowering species available, I used it in the hope that the opposite good traits in the gladiolus cultivars would overcome the weak points in *G. murielae* and only its beautiful scent would be dominant in the progeny.

G. murielae failed to set seed when pollinated by the gladiolus cultivars, but used as pollen parent on them, a few seeds were obtained ranging from 2 to 10 in each seed pod. Altogether 150 seed were harvested. 116 of these grew and flowered in their second growing season. Of these 114 were similar to the *Gladiolus* parent with no trace of *murielae* features, but the last two, rather smaller, plants to flower were apparently hybrids. Both had typical dark purple throat blotches and some *murielae* fragrance. Their seed parent, *Gladiolus* 'Filigree', had modified *murielae*'s long style, though the florets still tended to face downwards. The flower spike was upright and gave promise of carrying more flower buds with more florets than *murielae*. One plant had white florets (B66) and the other pink, similar to 'Filigree'. This was the nicer of the two, but sadly

was soon lost.

Plans were made to improve B66's rather plain appearance, while retaining its slight fragrance, by crossing it with *Gladiolus* cultivars having all the desirable traits. Many seedlings were raised, but none seemed better than B66 and the few that were fragrant were weak in this respect.

Finally B66 was self pollinated and again without an improved form appearing. I was about to abandon my fine plans and just keep B66 as a memento. Then my local high school horticultural instructor referred



'Rose Shape' (F3 x *Gladiolus* cv.)



V121 'Diana' (N99 x 'Rose Shape')

me to Dr. J.A. Rattenbury who was then Senior Lecturer in charge of the sub Department of Genetics at the University of Auckland. He became interested in my project and the many chromosome counts he did revealed some of the reasons for my poor results. Because 'Filigree' was a tetraploid ($4N=60$) as most gladiolus cultivars are, and *murielae* was a diploid ($2N=30$), the hybrid B66 was a triploid ($3N=45$)

As such it had irregular contributions of its chromosomes to its ova. Crossed with gladiolus varieties, the progeny were sub-pentaploids – around or less than 70 chromosomes. Though quite normal in appearance, they were sterile and what fragrance a few of them had was barely discernable. Studies of the pollen grains in B66 found them to be very variable in size; the larger were probably from 'Filigree' and seemed the only viable ones – only gladiolus-like seedlings resulted and none had any fragrance.

Dr Rattenbury suggested that B66's irregular chromosomal distribution could be utilised if it behaved as did those in a study reported by Jones and Bamford in the American Journal of Botany, Vol 29 No 10 1942. They found that gladiolus species hybrids sometimes passed all their chromosomes to some of their ovules. If B66 did this, any such ovules would have 45 chromosomes, and if fertilised by pollen from a diploid, the 15 chromosomes it contributed would bring the

total up to 60, a neat tetraploid number that would have regular chromosome pairing and distribution to the ovules. Any progeny in turn would have improved potential as parents. So B66 was backcrossed to its diploid parent, *G. murielae*, there being no other suitable diploid available. Very few B66 flowers set seed but 18 were eventually harvested. Only 6 seeds germinated with 4 surviving to flower 2 years later.

Chromosome counts showed that these new plants were tetraploids ($4n = 60$). Though having an extra set of 15 chromosomes from *G. murielae*, they were not any more like it than B66 in appearance, with the important exception that they had better scent, but still not as strong as in *G. murielae*.

Using the strongest plant (numbered F3), numerous crosses were made with good quality gladiolus cultivars and a reasonable number of seeds obtained. Using F3 as the seed parent gave the best results. Progeny mainly resembled the *Gladiolus* parent and nearly all had some fragrance, though again less than the hybrid. The *Gladiolus* parent seemed to influence this factor with some enhancing it and others depressing it.



F3 – named 'Lucky Star'
(B66 x *Gladiolus callianthus* var. *murielae*)

So I had proved that F3 would pass some scent to its seedlings in crosses with non fragrant gladiolus cultivars, but usually less than it had itself. Because of its genetic makeup, it could contribute only one set of gladiolus cultivar chromosomes and one set of *G. murielae* chromosomes to each ovule, literally halving the scent producing genes each seedling would receive. As mentioned above some gladiolus cultivars seemed to enhance the *G. murielae* fragrance, but the small numbers of seedlings I was raising from each cross was probably not exploiting all the possibilities for the progeny to show the best combination of both good form and fragrance. Breeding much larger “families” seemed a possible solution. But other work responsibilities meant there was no time to do the extra work. There was also a serious shortage of animal-proof areas in which to grow them. Some potentially good material had already been lost in this way. Rather than run the risk of losing any more, it was decided that corms of F3 should be distributed to other enthusiastic hybridists to experiment with as they saw fit.

In 1966, Dr Rattenbury and I presented a joint paper detailing its development at a Genetics Society meeting at Massey University. We also wrote articles about ‘Lucky Star’, as it had been officially named, for the North American Gladiolus Council Bulletin, and the British Gladiolus Society Annual. Eventually several overseas and commercial hybridists obtained corms. Most reported they liked ‘Lucky Star’ when it flowered for them and were hopeful it would be the bridge over which *G. murielae* would pass its scent to non fragrant gladiolus cultivars. Mr Clark, in England, produced a nice specimen by crossing ‘Lucky Star’ with ‘Acacia’ which was one of the best softly scented American gladioli.

Actually I had attained my original goal of breeding a summer flowering gladiolus with fair scent when F3 appeared on the scene. Though it seemed advisable to release it to other hybridists before I had produced a “world-beater” with lovely florets and fragrance, I still thought of ways to increase the scent that F3 progeny would inherit. Because of the unique behaviour of gladiolus species hybrids at meiosis, making another triploid by crossing F3 with *G. murielae* seemed a possibly successful first step. Such plants would have one set of gladiolus chromosomes and one set of *G. murielae* chromosomes from F3, and one set of *G. murielae* from *murielae* itself.

A few years later I had moved to a new home with a larger area of animal-proof garden. I still had a few plants of F3 and *G. murielae* and couldn’t resist trying to produce such a triploid. The few plants duly raised strongly resembled *G. murielae* and had almost as much scent, but they seemed sterile and were not pretty enough to be kept for decorative purposes.

Then I tried using *G. murielae* as the seed parent (never before successful as such) and a strongly growing self pollinated seedling from F3 as pollen parent. Surprisingly a few seed were obtained. Four of these grew but only one survived to bloom in the third season of growth. From a very large corm, N99 was a taller plant than either parent. It had rather untidy florets which sometimes lacked the throat blotches, and the fragrance was nearly as good as that of *G. murielae*. A chromosome count revealed it was a tetraploid ($4n=60$) and not the triploid expected. It would only cross with



B66 – *Gladiolus* ‘Filigree’ pollinated by *Gladiolus callianthus* var.

gladiolus that had *G. murielae* one or more generations back in their pedigree. Few seeds were obtained from each cross and the progeny all had slightly better fragrance than those F3 had produced, but not remarkably so. Then two seedlings appeared that had fragrance just as strong as in N99. The pollen parent had been a faintly fragrant good type of flower. These two new plants – one light pink and the other medium pink – were quite attractive and seemed

worth multiplying. The medium pink, numbered V121, was the better propagator so was the one selected to increase with the aim of commercial release.

I had marketed 'Lucky Star' myself but the newer regulations regarding the obtaining of permits to export (and import) dormant corms seemed more involved than before, so the stock of V121 was sold to a commercial bulb grower in Palmerston North. His plan to sell it to American firms was not realised and it has not been widely distributed in New Zealand.

Because he had exclusive rights over V121, I did not try to publicise it myself. The New Zealand Gladiolus Council Bulletin gave it brief and favourable mention and reported it as the winner of a class at a Christchurch flower show. Though the Palmerston North Bulb Farm has cancelled its exclusive control over 'Diana', as they named it, ill health has prevented me from taking advantage of this by way of writing articles for gardening magazines here and overseas – until now, just 50 years since my project began! Gladiolus fans of novelty types will find 'Diana' good in the garden and very suitable for flower arrangements. It needs similar treatment in every way to that required by any other gladiolus.



V121 'Diana' (N99 x 'Rose Shape')



B66 – *Gladiolus*
'Filigree' x *Gladiolus*
callianthus var.
murielae

N99

Seed Collecting in Africa

Rachel Saunders

ALL PHOTOS BY THE AUTHOR

“What a wonderful job and what a wonderful life” is the reaction of most people when we tell them what we do. And yes, sometimes it is, but, like all jobs, sometimes it isn’t! Our job takes us all over Southern Africa from the southern most tip near Cape Town, to the north of Zambia, about 4000km away; from the Atlantic Ocean in the west of Namibia to the Indian Ocean in the east. We see deserts, grasslands and lush forests; rain, snow and boiling heat; mountains and rolling plains. We also see environmental destruction on a massive scale, varying from pine and eucalyptus plantations to urban sprawl, golf estates, mining operations and agriculture such as wheatlands and vineyards.

To put it in a nutshell, what our job involves is travelling through the country collecting seeds from as many species as possible on the way. We travel in a 4 wheel drive pick-up Landcruiser, and we walk as much as we can. We have a small fridge in our car to keep the beers cold, and at night we sleep in a roof-

top tent which keeps us away from the dust and dirt and animals on the ground. We collect seeds in friend’s gardens, on road verges, on farms and in forests, on the sea-shore and high in the mountains. And obviously, during our travels, we have many experiences – some wonderful, and some not so wonderful!

Firstly, the weather. Living in a tent, walking in the mountains and collecting seeds, we are 100% exposed to whatever weather conditions the gods throw at us. We have had several not to be recommended experiences in the mountains while walking, most of them involving rain and snow. Once in the Drakensberg we spent the night in a cave high in the mountains close to the Lesotho border. In the morning we set off in beautiful clear weather with the sun shining warmly down and a gentle breeze. As we walked into Lesotho over the collapsed border fence, for some reason I tied a small piece of plastic to the fence above the cave. We walked all morning



Walking in Northern Namibia – could also be Tough Job!

collecting seeds and had lunch near a clear and lovely stream. Early in the afternoon we noticed some small clouds, which rapidly grew into bigger clouds and half an hour later we were enveloped in thick mist. By then we had walked several kilometers, and we suddenly realized that we had to find one small cave in a large white landscape! We kept our heads, turned in the direction that we thought we should be going and tried to walk in as straight a line as possible towards the escarpment. After 45 minutes or so, we hit the border fence, so our straight line was pretty good! Keeping the fence on our left, we walked up hills and down valleys until we finally saw our little piece of plastic, waving in the breeze! With great relief we climbed over the fence, found the cave and had a hot cup of tea! The next morning we woke up to thick snow on all the surrounding high peaks – a beautiful sight.

On another occasion we were walking in the Chimanimani Mountains in eastern Zimbabwe in winter, the dry season. During the night, to our surprise, we heard the sound of rain on our tent. By morning, our tent was floating and our flat plain had turned into a shallow lake! We packed up in the rain and decided to head for our car which was parked at the base of the mountain, a day's walk away. We were unfortunately on the wrong side of a major river which drains the mountains, and we soon found that we couldn't cross the river which was now in flood. Our only option was to stay on our side of the river and to walk to a large and comfortable cave that we knew of 2 or 3 hours away. So off we went, but our memories of the route were not too accurate and we had forgotten that we had to cross 3 side rivers, which of course were also in flood! With our packs on our heads and clutching onto half submerged trees, we managed to get across them and by lunch time we reached the cave. By then our clothes were soaked but our warm sleeping bags were dry, so we had lunch huddled in our bags at the back of the cave, watching the rain pouring down. Later in the afternoon the rain stopped and a rather watery sun emerged from the clouds. "By morning the river should be down and we will be able to cross easily" said Rod, so we spent the afternoon collecting wet seed into paper bags. However, as the sun set, the clouds rolled back in and as we ate our rather meager supper, down poured the rain again! By morning we felt desperate – our food was running out, the rain was still bucketing down, and a brief excursion to our little nearby stream showed us a raging torrent! Clearly the main river would still be uncrossable. Finally by lunch time the rain stopped and in the late afternoon we decided to pack up and



Packing the car!

walk as far as we could on our side of the river, and then try to cross. So off we went. Shortly before darkness fell we found a spot where the river narrowed with a large rock on our side. Rod threw his rucksack across the river and then leapt after it, thankfully getting across. After throwing my pack towards Rod, I jumped and was hauled across by my ski pole walking stick, landing with one foot in the river. I burst into tears with relief, and after sorting ourselves out, we walked until we found a level spot where we put up the tent and ate our last slice of bread for dinner!

Normally however, we curse the heat far more than the cold and rain, and we more often collapse exhausted and hot into cold mountain pools to seek relief. Often while driving through the Karoo or Namaqualand, we look for farm dams or reservoirs, and leap in, sometimes clothes and all to cool off.

Obviously the weather also has a huge effect on the seeds that we are collecting. If it has been too dry, we frequently find no seed at all – the flowers simply fade away, setting no seed. If it is too cold and wet, the same may occur as most pollinators need temperatures of at least 16 C to fly. Cold weather also affects the time seeds take to ripen – most Irid seeds normally ripen in 6 weeks, but cold weather



Collecting *Roridula* (carnivorous plant) seeds



Rachel and her Ostrich

can retard this to as long as 8 weeks. Similarly hot dry weather can shorten ripening to 5 or even 4 weeks. This results in our most frequent lament “green or gone!” Particularly annoying when one has traveled 1000km to collect some special seed, to find one missed it by a week! If we find slightly green seed, it can often be ripened in jars of water which are precariously arranged in the back of our vehicle, but there is nothing that can be done about “gone” seed.

Secondly, the actual process of seed collecting can also be “hazardous”. Like the day we were collecting seed of *Rhus pendulina*, a large tree frequently used as a street tree in low rainfall towns. We collected the seed into an upturned umbrella which is efficient and very quick, and transferred it into a paper bag. We then went into the local shop to buy some lunch, and drove on our way. About 10km further on, Rod suddenly shrieked “There’s something in my beard. STOP!!” I hurriedly stopped, peered into his beard, and burst out laughing – it was a baby chameleon! It had obviously fallen out of the tree into his beard while we were collecting the *Rhus* seeds. We wondered how many people in the shop had noticed, but its camouflage was perfect!

Another amusing encounter with chameleons was on a cold winter’s day in Johannesburg. We were collecting *Combretum* seeds – these seeds hang in clusters and are easy to collect in great handfuls. As I grabbed a bundle of seeds, I felt a cold and almost clammy thing in my hand, and dropped it with a scream. We dug around in the seeds to see what it was and found a tiny chameleon in hibernation in the middle of the seed cluster! Rod made some remark about feeble hysterical women, but a minute or two later he also let out a scream – he had found one too!

Another day was potentially more disastrous. Rod went wandering off while I packed up the lunch, and suddenly he came running back, waving his arms and shouting “Get into the car” – so I did! He opened the door and leapt in, together with a large number of bees, buzzing angrily around his head. He had unfortunately chosen to have a pee on top of a bee nest, in the ground under some grass! They had taken exception to this, and had come out fighting! African bees have a well deserved reputation for being fierce, and fierce they were. Rod drove off rapidly and opened all the windows trying to shoo the bees out. He got stung about 10 times, but I am allergic to bee stings, so my efforts at bee removal were frantic! We stopped a short distance down the road to clear the car of the last stragglers and I realized that I had a bee under my shirt. Without

thinking I desperately tore my shirt off, to the amazement of all the motorists on the busy highway, but I didn't get stung!

Travelling as we do in some very out-of-the-way places, we often encounter wild life of varying sorts. One day in Namibia we were lucky to see a herd of gemsbok, 2 jackals and a pair of honey badgers early one morning in the middle of the Namib Desert. In the Drakensberg we were woken up one night by noises around our tent, and we realized that something was eating our ripening seeds propped up in their jars of water. We leapt up shouting and whatever it was ran off. We went back to sleep muttering about "damn donkeys, the scourge of Africa". Next morning we peered out of the tent to find a herd of Eland, looking longingly at our *Agapanthus* and *Galtonia* seed spikes which were now safely out of reach. Not donkeys at all!

And of course we quite often see snakes – sometimes pythons or mambas that reach right across the road, but more often fat lazy puff adders which are very poisonous snakes that often bite when walked on. They love the warmth of the road, and because most people run over them deliberately if they see them, we always stop to move them from danger. We carry a long handled pole pruner with us, and it is very useful for prodding snakes out of the road!

Probably our funniest encounter with wild life was the day we met an ostrich! We were walking in a nature reserve in Swaziland and suddenly noticed that we were being followed by an ostrich. It was right behind us, and each time we stopped to look at a plant, it stopped too, and scratched around in the soil, looking for insects to eat. We walked about 6 or 7 km, with our ostrich accompanying us all the way. We came round a corner and almost fell over a litter of warthog babies which seemed to have lost their mum. They ran towards us, squealing madly, and we nearly had a fit – warthog mothers are extremely fierce and charge without hesitating, and we didn't really want to meet mum! We turned round and fled, and our ostrich fled with us – she obviously didn't want to meet mum either! All 3 of us walked back to the camp site for supper – a barbecue for us and bread for the ostrich.

We do quite often have problems with donkeys, cattle and sheep, particularly with bulb seeds. Normally each year we try to visit an area in flower, and then we go back 5 to 7 weeks later for seed. And frequently during our absence, the farmer puts his stock into the field, and that's the end of our seeds. Particularly *Gladiolus* spikes and almost always, it is a rare *Gladiolus* that grows a long way from home!



Grass seed collection in Zimbabwe



Rod collecting tree seeds using a pole pruner



Camp site in *Brachystegia* woodland in Zambia



Camp site on the Kafu River in Zambia



Caught by seeds!

Another strange problem we have had was with mice. Quite a few of the seeds that we collect are expelled from their seed capsules by an explosive or extrusion mechanism. Explosive capsules include the Rutaceae such as *Agathosma* and *Coleonema*, and those that are pushed out or simply fall out include Proteaceae such as *Paranomus* and *Serruria*, and Irids such as *Nivenia*. The simplest method of collecting these seeds is to either envelop the entire plant in a net made of net-curtain material, or to cover the flower head with a stocking tied around the base. One hot summer's day we spent a couple of hours at a population of *Serruria* tying stockings onto old flower heads with string. About a month later we returned to the site to see if the seeds had been released yet, and found that they had. So we began removing the stockings, untying them carefully over a paper bag to catch any seeds that fell out. As Rod clutched a stocking prior to untying the string, it wriggled! He jumped

backwards in fright and then burst out laughing as a mouse peered out of a hole, whiskers bristling! *Protea* seeds are oily and very nutritious, and a population of lucky mice had



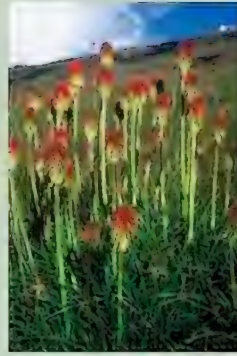
Our tissue culture lab with annual seed production in foreground



Annual seed collection using a vacuum cleaner

discovered our bags full of seeds. Needless to say, we got no *Serruria* seeds that year!

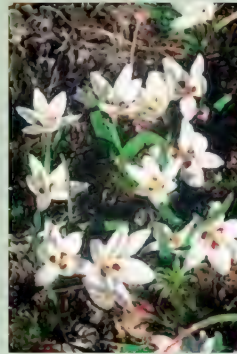
However, despite all the hazards and trials and tribulations, we do have some good days too. Those early spring days in the Cape mountains when the weather is warm but not too hot, the ground is wet from the previous day's rain and the flowers are magnificent. Or summer days in the rolling foothills of the Drakensberg mountains in undisturbed high altitude grasslands. This is the habitat for sheets of kniphofias, hundreds of species of ground orchids, *Agapanthus* and *Eucomis* in the gullies and Lammergeier eagles soaring above. Or if seed collecting becomes too much on wet rainy days or on hot summer days, we can always go wine tasting at one of the wineries in the SW Cape, or head for the beach! Then we agree with all those people who think we have a wonderful life!



Kniphofia baurii



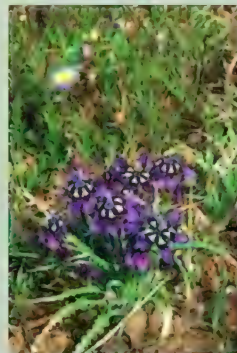
Moraea falcifolia



Hesperantha luticola



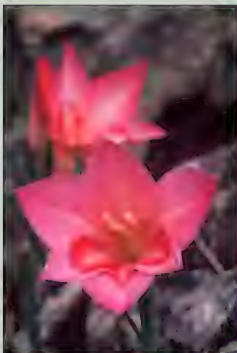
Gladiolus kamiesbergensis



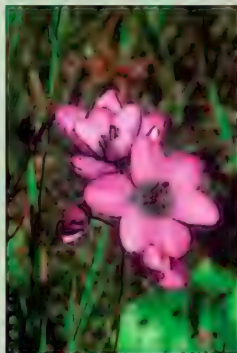
Lapeirousia oreogena



Gladiolus serpenticola



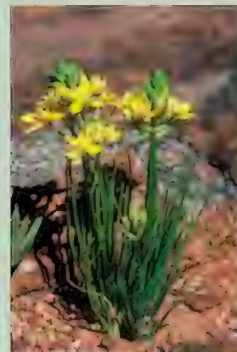
Gladiolus carmineus



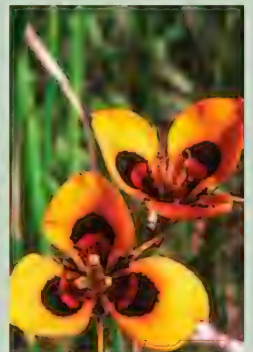
Ixia versicolor



Nerine platypetala



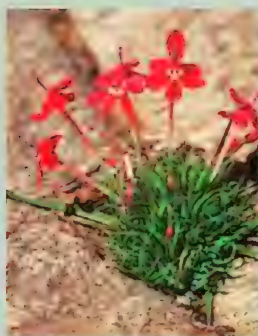
Ornithogalum multifolium



Moraea tulbaghensis



Hessea breviflora



Lapeirousia silenoides



Lachenalia pustulata



Babiana villosa

A Synopsis of the Biosystematic Study of the Seven Minor Genera of the Hyacinthaceae

Alison Summerfield

The family Hyacinthaceae is characterized by geophytes of which the underground part is a bulb, the inflorescence a simple raceme, the perianth segments free or united at the base and the fruit a capsule. It includes, amongst others, the following South African genera: *Amphisiphon*, *Androsiphon*, *Daubenya*, *Massonia*, *Neobakeria*, *Polyxena* and *Whiteheadia*.

The taxonomic history of the minor genera of the Hyacinthaceae largely reflects the significance that has been placed on morphological differences among the Hyacinthaceae in the past. Particular value has been placed on floral differences, resulting in the description of several monotypic genera for newly discovered species that were more or less distinctive in their flowers. Great significance was also attached to differences in leaf morphology, resulting in several

new species of *Massonia*, which are now placed mostly in synonymy under *Massonia depressa* or *Massonia echinata*. Within the Hyacinthaceae, the taxonomic position of the genus *Neobakeria* has always been problematic as it has been recognized by some authors and completely ignored by others.

With the advancement in science and technology more tools become available for unraveling taxonomic relationships. One of the latest tools, the DNA analysis, was used in this study and provided a useful phylogenetic analysis of the minor genera of the Hyacinthaceae. The main phylogenetic analysis revealed three distinct lineages i.e. *Massonia*, *Polyxena* and *Daubenya* with *Whiteheadia bifolia* remaining on a branch of its own outside of the *Massonia* clade.

The species within the *Massonia* clade are *Massonia depressa*, *Massonia echinata*, *Massonia*



PHOTO BY BILL DIJK

Daubenya zeyheri

grandiflora, *Massonia jasminiflora*, *Massonia hirsuta*, *Massonia sessiliflora* and *Neobakeria heterandra*. The DNA data indicates that *Neobakeria heterandra* should be transferred to the genus *Massonia*. Morphological evidence also supports this as both the flowers, with the characteristic sigmoid curve in the perianth and the paired, ovate to suborbicular leaves of *Neobakeria heterandra* are very similar to that of the other *Massonia* species. Müller-Doblies and Müller-Doblies (1997) stated that the correct name for *Neobakeria heterandra* should be *Massonia pygmaea* Schlechtendal ex Kunth and although they based their research purely on the study of herbarium specimens, with no contribution of DNA data, they were correct in the assignment of the name *Massonia pygmaea*.

Massonia grandiflora differs from *Massonia depressa* only in the size of the flowers and leaves, which are slightly larger in *M. grandiflora*. *Massonia grandiflora* has, however, often been considered deserving of its species rank by previous authors. DNA data shows the



Polyxena



Daubenya alba



Massonia depressa



genetic sequence of *M. grandiflora* to be identical to that of *M. depressa*, thus indicating that it should be reduced to the synonymy of *M. depressa*.

Jessop (1976) considered *Massonia hirsuta* to be a synonym of *Massonia echinata*, but Müller-Doblies and Müller-Doblies (1997) resuscitated it to species level, with which I agree. *M. hirsuta* shows sufficient morphological variation, especially with regard to the leaf morphology and the hairy bracts (which are not found in any other species) to deserve its species status.

The *Polyxena* clade includes the species: *Polyxena brevifolia*, *Polyxena corymbosa*, *Polyxena longituba*, *Polyxena maughanii*, *Polyxena paucifolia*, *Polyxena pygmaea* and *Lachenalia pusilla*. The latter was included in the DNA study because of the differences in morphology exhibited between it and other *Lachenalia* species, as well as the similarities it showed to species in the genus *Polyxena*. The DNA results showed a close relationship between the genus *Lachenalia* and *Polyxena*.

Polyxena brevifolia (Ker-Gawl.) A.M. van der Merwe is the correct name of the '*Polyxena corymbosa*' specimens from Gordon's Bay. Jessop



Polyxena paucifolia

(1976) considered *Scilla brevifolia* Ker-Gawl. to be a synonym of *Polyxena corymbosa*, but

according to the original description *Polyxena corymbosa* has a corymbose inflorescence whereas *Polyxena brevifolia* has a racemose one. Sequence data supports the morphological differences between the two species and justifies the species status of *Polyxena brevifolia*.

There appears to be a very close relationship between *Polyxena maughanii* and *Polyxena ensifolia*.

Morphologically the two species differ only in the length of their stamens, which in *Polyxena maughanii* are included in the perianth tube with the three longest ones just reaching to the mouth of the tube, while in *Polyxena ensifolia* the three longest stamens are exerted beyond the tube. Both species share the same general distribution area, but *Polyxena maughanii* is restricted to limestone outcrops within this area. These two taxa should be lumped into a single species with separate varieties *Polyxena ensifolia* var. *ensifolia* and *Polyxena ensifolia* var. *maughanii*, providing for the minor difference in stamen length and the preference of *Polyxena maughanii* for limestone substrates.

Polyxena longituba, although also very closely



Daubenya daurea

related to *Polyxena ensifolia*, reveals sufficient morphological variation both in flower shape and size and leaf shape to retain its specific rank.

Polyxena pygmaea shows sufficient variation, both in the DNA data set and morphological characters to retain its species status. *Polyxena paucifolia* and *Polyxena corymbosa* are very closely related, but they differ in flower morphology as well as in the number of leaves per species, with *Polyxena paucifolia* only having two leaves per plant, whereas *Polyxena corymbosa* has four to six. The pink flowers of *Polyxena corymbosa* are characterised by a short perianth tube, which is only about one third of the length of the perianth segments, while in *Polyxena paucifolia* the flowers are dark lilac to purple with a perianth tube that is equal in length to the perianth segments.

The *Daubenya* clade includes all the monotypic genera (except for *Whiteheadia bifolia*), as well as *Neobakeria comata*, *Neobakeria namaquensis* and *Neobakeria angustifolia*. Two collections of *Neobakeria angustifolia* were made, one from Sutherland and one from Saldanha. These two specimens differ remarkably with regard to both inflorescence type and floral morphology. The flowers of the *Neobakeria angustifolia* specimen from Sutherland are yellow and firm textured, with yellow or orange stamens, while those of the specimen from Saldanha are white with a papery texture and purple stamens. In the Saldanha specimens the perianth tube is also much narrower than that of the Sutherland specimen. DNA analysis also reveals two different genetic sequences, confirming the morphological differences and justifying splitting the species into two. It has since been determined that the respective names of the species should be *Massonia marginata* Willd. ex Kunth (Manning & Van der Merwe in press) for the Sutherland specimen and *Massonia zeyheri* Kunth

(Muller-Doblies & Muller-Doblies 1997) for the Saldanha specimen. DNA data shows that *Amphisiphon* shares a close relationship with *Massonia zeyheri* and *Massonia marginata*, but there are sufficient morphological differences to retain separate species status. DNA data also shows that *Daubenya aurea* is closely related to *Amphisiphon stylosa*, *Massonia marginata* and *Massonia zeyheri*. Although *Androsiphon capense* and *Daubenya alba* appear to be closely related,



Daubenya capensis



Daubenya marginata

they differ morphologically in that the flowers of *Daubenya alba* are white to pale lilac, whereas those of *Androsiphon capense* are bright yellow to orange. Another significant difference is the disc present on the top of the staminal tube in *Androsiphon capense*, that is lacking in *Daubenya alba*. DNA data clearly shows that the species in the *Daubenya* clade (*Daubenya alba*, *Daubenya aurea*, *Amphisiphon stylosa*, *Androsiphon capense*, *Massonia marginata*, *Massonia zeyheri*, *Neobakeria comata* and *Neobakeria namaquensis*) should be placed together in a single genus. As *Daubenya* is



Daubenya stylosa

the oldest genus within the group, the other species will all be transferred to *Daubenya* and will be known as *Daubenya alba*, *Daubenya aurea*, *Daubenya stylosa*, *Daubenya capensis*, *Daubenya marginata*, *Daubenya zeyheri*, *Daubenya comata* and *Daubenya namaquensis*.

Whiteheadia bifolia is the only species that retains its monotypic status, and the DNA analysis supports the unique morphology of the species as it appears on a branch of its own on the outside of the *Massonia* clade

In the past most taxonomic classifications have been based solely on morphological differences or similarities, and although some of these classifications are still viewed as valid, many others have been proven incorrect as new data has become available. Morphological characters are the easiest to use when classifying taxa, as they are the most obvious to the eye. However, it is sometimes difficult to exercise objectivity when viewing them, as very often there are superficial resemblances between plants that support the pre-conceived ideas we have as to the relationships between them. The most reliable and realistic phylogeny can only be produced through the combination of all known data on the taxa, including morphological, anatomical, palynological and molecular information. In this thesis phylogenetic characters were used to bring clarity to the morphological characters and the morphological characters were used to test the phylogenetic tree.



Daubenya comata



Daubenya namaquensis



Polyxena corymbosa



Polyxena brevifolia



Daubenya zeyheri



Massonia depressa



Massonia echinata



Massonia pygmaea



*Massonia
pustulata*



*Massonia
jasminiflora*

Key to the species of *Daubenya*

Filaments united into a narrow, cylindrical tube 9-20 mm long

Flowers slightly zygomorphic; white to lilac-tinged *D. alba*

Flowers actinomorphic; yellow to orange

Tepals prominent, 11-15mm long, spreading from base of staminal tube; disc present on top of staminal tube; styles non-persistent on capsules *D. capensis*

Tepals reduced, up to 2mm long, minute at top of perianth tube; staminal disc absent; styles persistent on capsules *D. stylosa*

Filaments free or united into a short, wide tube ca. 3 mm long

Lower flowers of inflorescence strongly zygomorphic with three large tepals and three smaller ones, differing greatly from upper flowers; coma of bracts absent *D. aurea*

Lower flowers of inflorescence slightly zygomorphic or actinomorphic; lower and upper flowers subsimilar or the same; coma of bracts present

Perianth tube of lower flowers 25-45 mm long; tepals recurved; filaments all free *D. comata*

Perianth tube of lower flowers 10-25 mm long; tepals suberect or spreading; filaments all or partially united into a tube

Flowers bilabiate, tepals equally fused, linear; flowers scented *D. namaquensis*

Flowers not bilabiate, tepals not equally fused, ovate to lanceolate; flowers unscented Inflorescence conical, protruding well above leaves; tepals yellow to orange, somewhat fleshy; stamens yellow to red; conspicuous coma of orange or yellow bracts *D. marginata*

Inflorescence capitate, hardly protruding above leaves; tepals white, papery; stamens red with purple base; inconspicuous coma of small green bracts *D. zeyheri*

Geographical Distribution and Ecology

Daubenya alba occurs in scattered colonies along the edge of the Roggeveld escarpment, between Calvinia and Middelpos. The species grows in heavy doleritic clay, as do most of the other *Daubenya* species. Plants appear to be restricted to the lower-lying drainage areas. The flowers are strongly scented during the day and night. Flowering time is from May to June.

Daubenya aurea is known only from a few localities between Sutherland and Middelpos on the Roggeveld escarpment. The plants occur in abundance in colonies, in low-lying areas in heavy doleritic clay. *D. aurea* shares this habitat with *D. marginata* (Willd. ex Kunth) J.C. Manning & A.M. van der Merwe, although the two species do not flower at the same time. The flowering time of *D. marginata* stretches from May to June and that of *D. aurea* from August to September. *D. aurea* occurs in two colour forms, the more abundant brilliant red form and the less common canary yellow form. Occasionally a dull orange form has also been observed. The two colour forms seem to differ slightly in flowering time, with the yellow form coming into flower a few weeks before the red one and the fruits also taking longer to reach maturity, remaining green long after the fruits of the red form have dehisced.

D. capensis is endemic to the Nieuwoudtville area, where it occurs in abundance in several populations around the village. It shares this habitat with *D. stylosa*, although it flowers much later than the latter. It is restricted to the red clay soil of the seasonally moist doleritic flats. Flowering time is June to July and the flowers emit a rather unpleasant, yeasty smell.

Of all the *Daubenya* species, *D. comata* is the most widespread, occurring from Beaufort West in the Northern part of the Western Cape to De Aar and Colesberg in the Northern Cape, through the Free State as far north as Bloemhof in the North-West Province. Plants grow in colonies in red, doleritic clay that is seasonally waterlogged. This species receives late summer rains, as is also the case with *D. namaquensis*. The rest of the *Daubenya* species fall mostly within the winter rainfall region. *D. comata* flowers from the middle of April to the middle of May and the flowers are strongly scented.

Daubenya marginata is widespread across the Roggeveld Escarpment and the western Karoo. It occurs from near Calvinia to Sutherland and eastwards along the Nuweveld scarp and inland near Fraserburg and Loxton. There are also a few isolated populations on the Knersvlakte, north of Vanrhynsdorp. In the Sutherland area plants occur together with *D. aurea* in red doleritic clays in seasonally moist depressions. In other areas they are more often found in silt or gritty clay. Flowering time is May to July, but sometimes extends into August.

Daubenya namaquensis is known only from a few collections from the semi-arid flats east of O'okiep and Springbok. This area lies on the extreme western edge of Bushmanland and is on the boundary between winter and summer-rainfall regions. *D. namaquensis* occurs in small colonies in lower-lying drainage areas in deep red sands. The bulbs are extremely deeply buried enabling the plants to make full use of any soil moisture. Flowering time is from the middle of May to the middle of June and flowers are strongly scented.

Daubenya stylosa is a highly local endemic and like *D. capensis* occurs only around Nieuwoudtville. It is known from a few populations in the immediate vicinity of the town, the Wildflower Reserve and the Farm Glenlyon. Plants are abundant in these populations and grow in the red doleritic clays so typical of this genus. Flowering time is May.

Daubenya zeyheri is restricted to the west coast area of the Western Cape. It is known from two populations, one at Paternoster and the other at Saldanha. The plants grow in dense clusters on sandy calcareous soils that are overlying limestone, unlike all the other *Daubenya* species which grow on doleritic clay. Flowering time is from the end of May until the beginning of July and flowers are unscented. Nectar is often visible in the ring of the staminal collar.

Key to the species of *Polyxena*

Leaves narrow, linear and canaliculate, 2–6 per plant

Inflorescence distinctly corymbose *P. corymbosa*

Inflorescence subcorymbose or racemose

Perianth tube very short, $\frac{1}{4}$ of the length of the perianth segments, inflorescence distinctly racemose, flowers campanulate *P. brevifolia*

Perianth tube equal in length to perianth segments or longer, inflorescence subcorymbose, flowers funnel-shaped

Perianth tube equal in length to perianth segments, stamens included in perianth tube, leaves always 2 *P. paucifolia*

Perianth tube at least double the length of the perianth segments, stamens exerted above recurved perianth segments, leaves 2 or 3 *P. longituba*

Leaves lanceolate or ovate, obtuse, 2 per plant

Perianth tube 3x the length of the perianth segments, perianth segments strongly recurved *P. pygmaea*

Perianth tube up to double the length of the perianth segments, perianth segments erect to spreading

Stamens included in throat of the perianth tube *P. ensifolia* var. *maughanii*

Stamens exerted beyond the throat of the tube *P. ensifolia* var. *ensifolia*

Geographical Distribution and Ecology

P. brevifolia is restricted to the Western Cape Province and occurs in scattered populations from Harmony flats between Gordon's Bay and Strand, to Stellenbosch, Paarl, Tulbagh and Ceres and as far north as the Clanwilliam area. The plants grow in low-lying drainage areas in sandy or clayey soil. Flowering time is April to June and flowers are pleasantly scented.

P. corymbosa is restricted to the Cape Peninsula and was originally collected on Lion's Head. The species occurs in isolated patches around Greenpoint, Bantry Bay and Camps Bay. Plants grow in sandy soil or

sometimes in gravelly soils and rock crevices. Flowering time is from April to June and flowers are pleasantly scented.

Polyxena ensifolia var. *ensifolia* is widely distributed and occurs mostly on clay or granite flats from Namaqualand through the Western Karoo, and as far east as Bathurst. Flowering time is from April to June and flowers are strongly scented.

P. ensifolia var. *maughanii* has a very limited distribution in the Western Karoo and Bokkeveld mountains. This variety shares its distribution area with *P. ensifolia* var. *ensifolia*, but is always restricted to dolerite outcrops. Flowering time is from May to June and flowers are pleasantly scented.

P. longituba occurs abundantly, but localised, in the Komsberg area in the Northern Cape, growing in damp lower-lying areas. Two separate populations are known, with one population having flowers that are off-white to pale pink and the other with more robust lilac flowers. Flowering time is from late April to May and the flowers emit a sweet, yeasty smell and they close at night. Flowers appear to be self-pollinated and the peduncles elongate during seed ripening.

P. paucifolia is restricted to the coastal granite and limestone outcrops of the Paternoster and Langebaan areas in the Western Cape Province. The plants grow in quite densely populated colonies scattered in this area. Flowering time is from April to June.

Polyxena pygmaea is known from two areas that are relatively isolated from each other, occurring in the Riversdale area and also in Namaqualand. The species grows on sandy flats, or sometimes in rocky localities on calcareous outcrops. Flowering time is from May to June and the flowers are highly scented.

Key to the Species of *Massonia*

Flowers robust and fleshy, perianth tube cup-shaped, 6-10mm in diameter *M. depressa*

Flowers delicate and membranous, perianth tube narrow, up to 5mm in diameter

Outermost bracts hairy, coma of green bracts present in centre of inflorescence *M. hirsuta*

Outermost bracts glabrous, coma of green bracts absent from centre of inflorescence

Stamens biseriate, of 2 lengths; leaves glabrous or pustulate but then with long hairs *M. pygmaea*

Stamens uniseriate, all of equal length, leaves glabrous, echinate or pustulate, but seldom hairy

Filaments long, 17-24mm; style long, 10-30mm; leaves pustulate *M. pustulata*

Filaments short, 2-8mm; style short 5-10mm; leaves glabrous, echinate or minutely pustulate

Perianth tube twice the length of the perianth segments, perianth segments sometimes lacking sigmoid curve; filaments 2-4.5mm; restricted to the Eastern and

Northern Cape Provinces and Lesotho *M. jasminiflora*

Perianth tube equal in length to perianth segments or slightly longer; perianth segments with sigmoid curve; filaments 5-8mm; widespread in the Western Cape Province *M. echinata*

Geographical distribution and ecology

Massonia depressa is widespread in the winter rainfall regions of the Western Cape and Namaqualand and also occurs in the Karoo. This species occurs in a wide range of habitats on both sandy flats and rocky slopes, either growing in the shade of other plants or in the open sun. Flowering occurs in July and August. The flowers usually have a yeasty scent and produce large amounts of nectar which accumulates in the cup formed by the short staminal tube. According to Johnson *et al.* (2001), *M. depressa* is pollinated by rodents which visit the plants at night to consume the nectar.

Massonia echinata is widespread in the Western, Northern and Eastern Cape Provinces from Calvinia in the north to Riversdale in the south and as far east as Middelburg in the Eastern Cape. *M. echinata* occurs in open, sandy areas, clay soils or rock crevices, mostly in the full sun. Flowering time is from May to July and flowers are sweetly scented.

Massonia hirsuta has a wide inland and southern coast distribution. It occurs from Mossel Bay in the west

to Port Elizabeth in the east, and as far north as Barkly West in the Kimberley area. It is also known from a few isolated populations in Namaqualand. *Massonia hirsuta* occurs mostly in sandy soil or doleritic clay, growing in the full sun. Flowering time is from May to July.

M. jasminiflora occurs in the summer rainfall area of the Eastern Cape, the Free State and Lesotho, extending to the west near Kimberley in the Northern Cape. *M. jasminiflora* occurs mostly in open grassveld, or sometimes in limestone gravel or calcrete. Flowering time is from May to June and flowers are highly scented.

M. pustulata is quite widespread in the Western Cape Province occurring from Calvinia in the north to Bredasdorp in the south and as far as Port Elizabeth in the east. It usually grows in the open in coastal sand, in dry inland areas and sometimes on clay. Flowering time is from June to September and flowers are sweetly scented.

Massonia pygmaea occurs along the mountain ranges of the Western and Northern Cape Provinces from Villiersdorp in the south, along the Cedarberg mountain range to Leliefontein in the Kamiesberge in the north. It is known to inhabit high altitudes in sand and in rock crevices. Flowering time is from April to May.

Geographical Distribution and Notes on *Whiteheadia*

Whiteheadia bifolia occurs in the western part of the Western Cape Province and Namaqualand and has also been recorded from the extreme south of Namibia. It grows amongst rocks and boulders, usually in pockets of humus-rich soil, in both dry and damp habitats. Flowering time is from June to July and flowers are unscented.

Taxonomic note: Müller-Doblies and Müller-Doblies (1997) described a new species of *Whiteheadia* from Namibia, thus altering the monotypic status of this genus. They have named the species *W. etesionamibensis* U. & D. M-D. According to their description, this species differs from *W. bifolia* with respect to the perianth tube which is much shorter (2–3mm) than that of *W. bifolia* (4–8mm) and the perianth segments which are much longer (in *W. etesionamibensis* 9.5–14mm and in *W. bifolia* 5–7mm). Unfortunately, although they state that an isotype of this newly described species is housed at the NBG herbarium, the herbarium has not as yet received such a specimen and I have been unable to verify the status of this species.

Table of Species Currently Recognized Together with their Synonyms

SPECIES	SYNONYMS
<i>Genus Daubenya</i>	
<i>D. alba</i> A.M. vd Merwe	-
<i>D. aurea</i> Lindl.	<i>Daubenya fulva</i> Lindl. <i>Daubenya coccinea</i> Harv. ex Baker <i>Daubenya aurea</i> var. <i>coccinea</i> (Harv.) Marloth
<i>D. capensis</i> (Schltr.) A.M. vd Merwe & J.C. Manning	<i>Androsiphon capense</i> Schltr.
<i>D. comata</i> (Burch. ex Bak.) J.C. Manning & A.M. vd Merwe	<i>Massonia comata</i> Burch. ex Baker <i>Polyxena comata</i> (Burch. ex Baker) Baker <i>Neobakeria comata</i> (Burch. ex Baker) Schltr.
<i>D. marginata</i> (Willd. ex Kunth) J.C. Manning & A.M. vd Merwe	<i>Massonia marginata</i> Willd. ex Kunth <i>Polyxena marginata</i> (Willd. ex Kunth) Baker <i>Massonia rugulosa</i> Lichtenst. ex Kunth <i>Polyxena rugulosa</i> (Lichtenst. ex Kunth) Baker <i>Polyxena haemanthoides</i> Baker <i>Neobakeria haemanthoides</i> (Baker) Schltr. <i>Massonia angustifolia</i> auct. non <i>M. angustifolia</i> (= <i>M. echinata</i> L.)
<i>D. namaquensis</i> (Schltr.) A.M. vd Merwe	<i>Neobakeria namaquensis</i> Schltr.

D. stylosa (Barker) A.M. vd Merwe & J.C. Manning

D. zeyheri (Kunth) J.C. Manning & A.M. vd Merwe

Genus *Massonia*

M. depressa Houtt.

M. echinata L.f.

M. hirsuta Link & Otto

M. jasminiflora Burch. ex Baker

M. pustulata Jacq.

M. pygmaea Schlechtendal ex Kunth

Genus *Polyxena*

P. brevifolia (Ker-Gawl.) A.M. vd Merwe

Amphisiphon stylosum ['stylosa'] Barker

Massonia zeyheri Kunth

Polyxena zeyheri (Kunth) Dur. & Schinz

Massonia pedunculata Baker

Massonia burchellii Baker

Neobakeria burchellii (Baker) Schltr.

Massonia angustifolia auct. non *M. angustifolia*
(=*M. echinata* L.)

Massonia latifolia L.f.

Massonia sanguinea Jacq.

Massonia obovata Jacq.

Massonia grandiflora Lindl.

Massonia brachypus Baker

Massonia triflora Compton

Massonia scabra Thunb.

Massonia muricata Ker-Gawl.

M. longifolia Jacq. var *candida* Burch. ex Ker-Gawl

Massonia huttonii Baker

Massonia setulosa Baker

Massonia tenella Soland. ex Baker

Massonia versicolor Baker

Massonia calvata Baker

Massonia latebrosa Masson ex Baker

Massonia amygdalina Baker

Massonia parvifolia Baker

Massonia dregei Baker

Massonia cocinna Baker

Massonia candida Burch. ex Baker

Massonia modesta Fourc.

Neobakeria visserae Barnes

Massonia angustifolia L.f.

Polyxena angustifolia (L.f.) Baker

Neobakeria angustifolia (L.f.) Schltr.

Massonia orientalis Baker

Massonia bolusia Barker

Massonia inexpectata Poelln.

Massonia sessiliflora (Dinter) U. & D. M-D.

Massonia bowkeri Baker

Massonia greenii Baker

Massonia schlechtendalii Baker

Massonia longipes Baker

Polyxena bakeri Dur. & Schinz

Neobakeria heterandra Isaac

Massonia heterandra (Isaac) Jessop

Scilla brevifolia Ker-Gawl.

Dipcadi brevifolium (Thunb.) Fourc.

Scilla brachyphylla Roem. et Schultes

P. corymbosa (L.) Jessop

P. ensifolia (Thunb) Schönl. var. *ensifolia*

P. ensifolia var. *maughanii* (Barker) A.M. vd Merwe

P. longituba A.M. vd Merwe

P. paucifolia (Barker) A.M. vd Merwe & J.C. Manning

P. pygmaea (Jacq.) Kunth

Genus *Whiteheadia*

W. bifolia (Jacq.) Baker

Periboea gawleri Kunth

Hyacinthus gawleri (Kunth) Baker

Hyacinthus corymbosus L.

Massonia corymbosa (L.) Ker-Gawl.

Scilla corymbosa (L.) Ker-Gawl.

Periboea corymbosa (L.) Kunth

Polyxena ensifolia (Thunb) Schönl.

Mauhlia ensifolia Thunb.

Agapanthus ensifolius (Thunb.) Willd.

Massonia ensifolia (Thunb.) Ker-Gawl.

Massonia odorata Hook.f.

Polyxena odorata (Hook.f.) Baker

Massonia uniflora Sol. ex Baker

Polyxena uniflora (Sol. ex Baker) Dur. & Schinz

Polyxena calcioli U. & d. M-D.

Polyxena maughanii Barker

-

Hyacinthus paucifolius Barker

Periboea paucifolia (Barker) U. & D. M-D.

Periboea oliveri U. & D. M-D.

Polyanthes pygmaea Jacq.

Hyacinthus bifolius Boutelou ex Cav.

Massonia violacea Andr.

Eucomis bifolia Jacq.

Basilea bifolia (Jacq.) Poir.

Melanthium massoniaefolium Andr.

Whiteheadia latifolia Harv.

I am a single mom with 3 children – Joshua (8) and twin girls Jessica and Danielle (5). I studied a BSc at Stellenbosch University with the idea of becoming a Biology teacher, but Botany caught my interest so I did my Honours and MSc in Botany. After I got my MSc I worked in the Botany department for a while before registering for my PhD. I got my PhD in 2002 and then worked as a part-time lecturer in the Botany department at Stellenbosch University. At the moment I am studying at UNISA (University of South Africa) to get my teaching diploma so that sometime in the future I will be able to teach Biology at school level. I have an avid interest in plants, especially the fynbos and geophytes and love to go camping. I enjoy wakeboarding and water skiing and look forward to playing hockey again once my studies are over.



– All photos by the author except where noted –

Creating the Right Environment and Conditions for Cultivation

By Gordon Summerfield

It is never my intention to tell people how to grow South African winter rainfall bulbs and corms, but rather to share my experience of growing them over the past 15 years or so.

The illustrated Oxford dictionary defines;

ENVIRONMENT: as – surroundings, region, conditions or influences and

CONDITIONS: as – circumstances, especially those essential to a 'things' existence.

With this in mind, I have adopted, over the last couple of years, a very simple common-sense approach to growing bulbs and corms.

My main interests are the winter rainfall geophytes of the Western Cape, Northern Cape, Namaqualand and to a lesser degree the Southern and Eastern Cape, and currently I have approximately 950 species under cultivation.

Until recent times little was written, documented and published on the active cultivation of our indigenous geophytes. Fortunately the Kirstenbosch Gardening series by Graham Duncan and the very recent "Color encyclopedia of Cape Bulbs" by Manning, Goldblatt and Snijman have helped to remove much of the previous 'myth' that these bulbs and corms were difficult, if not impossible to grow.

There are certain genera and species that do prove more difficult to grow, such as *Gladiolus bullatus*, *G. cardinalis* and *G. nerinoides* – however, by creating the right environment and conditions (similar to their natural habitat) it is possible to cultivate them, and others, successfully. In the "Color encyclopedia of Cape Bulbs" the authors state 'Most bulbs (and Cape bulbs are no exception) respond best in cultivation if their natural growth requirements are duplicated as closely as possible'.

Provided one uses a sound nutritious, (probably neutral) well-drained soil medium, the three next most important denominators for successful

cultivation are:

- Aspect (ie. situation)
- Planting strategy
- Feeding (and watering)

ASPECT: Ideal is a south/south-east aspect – preferably benefiting from morning sun, although full sun is not essential. The late afternoon setting sun can prove quite harsh, particularly in late Autumn or late Spring when temperatures on the whole are quite raised. In their natural habitat, far more geophytes (and general Fynbos) will be found on the cooler and damper S/SE facing aspects. Of course there are those plants which favour the drier and warmer N/NW aspect. A point of interest: many of the Iridaceae species will naturally flower facing S/SE.

HOUSING: Where one experiences heavy night/early morning dew, it is advisable to grow the softer leafed species, such as daubenyas, lachenalias, gethyllis, massonias as well as certain freesias, romuleas and geissorhizas amongst others, under cover. However, always ensure that there is sufficient natural light and good, free air movement. I certainly have enjoyed far greater success since adopting this approach; it has reduced incidences of crown rot, *Botrytis* and *Fusarium* infections to almost nil. One does, however, have to be extremely vigilant and most wary of infestations of mealy bug, aphids and red spider mite (due to the drier conditions) and take the necessary curative action. There is also a noticeable reduction in the incidence of rust to which certain species of lachenalias, such as *L. unifolia*, *L. variegata* & *L. viridiflora* are particularly prone. The need for full sun (whilst probably ideal) is not from experience essential or indeed necessary. Yes, one will produce slightly lankier plant growth, but then that is also what happens in their natural habitat when growing from under the protection of fynbos/shrubbery.

PLANTING: I always start with a good neutral, well-drained (ie. porous) soil medium, made up of $\pm 60\%$ river sand and $\pm 40\%$ commercial potting soil (containing no superphosphates!) to which I add additional nutrients/additives throughout the growing season. An aspect of planting that I overlooked for many years, to my detriment, is the depth that one plants mature bulbs and corms. Consider the normal growth cycle from seed. The plant pulls itself down to the optimum level before producing flowers. When planting mature or near-mature bulbs/corms, err on the shallow side rather than too deep. Too deep and you will produce spindly plants that will finally give up the ghost. On the other hand, planted too shallow, they might require a little more time to flower properly. Also don't be shy to plant your bulbs/corms grouped together ie. in the middle of the container. I am convinced there is a symbiotic influence. Certain corms such as *lapeirousias*, *romuleas* and *hesperanthas* are bell-shaped with a flat bottom – plant these at an angle to assist their movement down to the optimum level (I always make a note of the depth of existing bulbs/corms when re-potting).

FEEDING: An absolute no-no is the addition of any phosphates to the winter rainfall geophytes. However, they do respond well to a regular feeding (once per month) of magnesium

sulphate (good leaf structure), potassium sulphate (bulb and flowering development). Agricultural limestone should also be added for those requiring a raised pH above neutral which are most of the winter rainfall species and certainly all of the summer rainfall species. Associated with feeding is of course watering – provided one adopts a good growing medium ie. one that drains well, you can never, never over-water your bulbs and corms. Also another never, never is to allow your container to dry out! Where one experiences crown rot, provide water from below.

Finally temperature does have its part to play. Generally bulbs/corms are tolerant of extremes in temperature. For certain of our 'Alpine' types, such as *Gladiolus cardinalis* & *G. nerineoides* (to name but two), to flower successfully one needs to provide a cool S/SE aspect – for they flower in the Western Cape's warmer months, but at high altitude and thus much cooler.

Many myths and indeed untruths have been created and espoused around the difficulty of cultivating S.A. indigenous bulbs/corms which has unfortunately had a profoundly negative effect of creating an ethos of 'conservation through cultivation'. Fortunately in recent times a reasonable amount of good seed and bulbs/corms has become available to the enthusiast.

My first interest in the winter rainfall geophytes started in 1983 when we moved from Benoni (in the then Eastern Transvaal) to Cape Town.

Soon after moving to Cape Town I joined the Botanical Society and the Indigenous Bulb Society of SA (IBSA). I became a committee member of IBSA in 1989 and chairman in 1993 until 2001.

I retired from Norwich Life (previously Norwich Union) in 1996 with the idea of turning my ever growing hobby into a mail order business, spurred on by the lack of availability of winter geophytes, as well as the lack of understanding of how to grow them successfully.

I currently cultivate in excess of 40 genera and 900 plus species.



Book Reviews

by Kathy Andersen

**DAFFODILS IN FLORIDA,
A FIELD GUIDE TO THE COASTAL
SOUTH.** Linda M. Van Beck and
Sara L. Van Beck. Self-published,
Tallahassee, FL. Hardcover, 179
pp, 141 photos, 12 illus.
including hardiness and heat
zone maps. \$24.00 + shipping
and handling.
(www.FlaDaff.com).
ISBN 0-9759216-0-6. 2004.

Wishing to carry on the work of the late John Van Beck, husband of Linda M. and father of Sara L, these authors have expanded his initial research on growing daffodils in Florida. The text is suitable for those wishing to experience success with daffodils in the "Live Oak – Spanish Moss" belt from Beaufort, South Carolina to Houston, Texas. Bulb basics are clearly laid out along with practical know-how and much daffodil history.

Through test gardens established with help from the Florida Daffodil Society, Van Beck determined which daffodils thrived in his climate. Many of those which grew well were found established around abandoned homes, along roadsides and in old area cemeteries. He often had greater success with pre-1940 cultivars than with many of the more modern ones. Problems encountered in this zone 8 climate are lack of a dry season, high heat and excessive humidity. High temperatures in March can cause buds of late flowering cultivars to blast (overheat before opening and die without flowering). Cultivars which require a cold period to bloom and those which must be kept dry in summer do not succeed.

Daffodils in Florida

A FIELD GUIDE
TO THE
COASTAL SOUTH



Linda M. Van Beck
Sara L. Van Beck

Perhaps most valuable, are the evaluation lists generated from test garden results: cultivars that do not grow in the area, those that are marginal and those that multiply. The answers for success are not always predictable, but a look at species in the heritage is important, e.g., all hybrids derived from *N. jonquilla* thrive in the alkaline soils of the region. This book is an invaluable resource for those wishing to establish daffodils in such areas.

Thank You

Dear Members

A very special "Thank You" to all those loyal IBS members that unselfishly gave their bulbs, seeds, rhizomes, etc. for the IBS, Bulb and Seed Exchange, in 2004. Without your generosity, our Bulb and Seed exchange would not have been such a success.

Herbert Kelly Jr.

Director IBS Bulb and Seed Exchange 2004
(IBS BX & SX)

DONATIONS

Below are IBS members who made donations to various IBS Funds during calendar year 2004. The Directors wish to extend their sincere appreciation to these donors

Carl Amason
Kathryn Andersen
Justin Brown
Kirby Fong
Charles Hardman
Dave Lehmler
Kathy Macartney
Leo Martin
Cameron & Rhoda McMaster
Nickolas Nickou
John Rountree
Mike Rummerfield
Sir Peter Smithers
Harold Wilkins
Robert Willey
The LEF Foundation

TELOS *RARE BULBS*

P. O. Box 4147, Arcata, CA 95518 USA

www.TelosRareBulbs.com

We offer a wide selection of hard-to-find bulbs all grown in our nursery.

**Bulbs of the Western USA
Bulbs from Central & South America
Bulbs of Southern Africa
Bulbs from the rest of the world**

**CATALOG FREE
TO IBS AND PBS MEMBERS**

We are now exporting



*Silverhill Seeds
& Books*

SOUTH AFRICAN SEED AND BOOK SPECIALISTS

P.O. Box 53108, Kenilworth
7745 Cape Town, South Africa
Tel: +27 21 705 0295 Fax: +27 21 706 7987
e-mail: rachel@silverhillseeds.co.za
Website: www.silverhillseeds.co.za

A catalog of seeds and books of bulbous and cormous plants for the connoisseur.

We source and supply seed of over 400 species of native South African bulbous, cormous and rhizomatous plants from the fynbos, grasslands and mountains, as well as a diverse selection of books.

From Amaryllids to Zantedeschias

See instructions on our website to find our online catalog
or contact us for a printed catalog at the email address,
fax number or postal address above

International Bulb Society
PO Box 336
Sanger CA 93657
USA

PRSRT
US POSTAGE
PAID
SPENCER-WALKER
PRESS

BULBS

Bulletin of the International Bulb Society



Volume 6 No. 2

July – December 2004

Price \$5.00

International Bulb Society

Directors

Alan Meerow	President/Co-Director, Publications/Science	
Kathy Andersen	Secretary/Assistant Mailing	Tony Palmer
Dave Lehmler	Membership/Mailing	Pam Kelly
Karl King	Webmaster	Herb Kelly Jr
		Awards/Seed Exchange

International Representatives

Rachel Saunders	South Africa	John Grimshaw	UK & Netherlands
Andre Gaboriau	France	Tony Palmer	New Zealand
	Alberto Grossi		Italy

Bulbs

The Bulletin of the International Bulb Society

Editorial Staff

Editor Tony Palmer Associate Editor Alan Meerow

Do you have comments? We want to hear from you!

Send comments to: BULBS - Editor, 12 Kelly Road, Oratia, Auckland New Zealand.

Email to: adpal@ihug.co.nz

Membership Information

Join the International Bulb Society! Member benefits: annual *Herbertia*, semi-annual *BULBS*, educational website, email "IBS Members Forum", Seed Exchange (SX) and Bulb Exchange (BX) (for members of the email "IBS Members Forum").

1 Year US	\$40.00
1 Year International (air mail: <i>Herbertia</i> ONLY)	\$45.00
1 Year International (air mail: <i>Herbertia AND BULBS</i>)	\$50.00

Make payable to: IBS (in US funds only) and mail to:

Dave Lehmler, Membership Director
3530 Fannin, Beaumont, TX, 77701, USA.
Email to: IBSMEM@aol.com

*If paying by credit card, enclose your card number (MasterCard or VISA only) and expiration date. Or you may apply online via secure server: www.bulbsociety.org

Join the IBS Email "IBS Members Forum"!

Contact Alan Meerow: prez@bulbsociety.org

TABLE OF CONTENTS

First Words	Tony Palmer	2
Germinating <i>Alstroemeria</i> Seeds	Mark Bridgen	3
Advanced <i>Crinum</i> Hybrids	David J. Lehmiller	4
<i>Alstroemeria</i> of Chile	Mark P. Bridgen & Eduardo A. Olate	9
NCCPG National Plant Collection® of <i>Freesia</i> (<i>Anomatheca</i>)	David Fenwick	15
Sand/Clay the Preferred Medium	Daryl Geoghegan	19
Book Reviews		23
<i>xHippeastrelia</i> is Facultatively Apomictic	Ben J.M. Zonneveld	25
Guidelines for IBS Members		27

ADVERTISE IN BULBS!

ADVERTISERS: If you have a small nursery (or not so small) consider advertising in BULBS. Our readers have demonstrated their wish to support businesses that advertise in The International Bulb Society publications. Please contact Tony Palmer. Email to: adpal@ihug.co.nz

Ad Rates:	BLACK & WHITE		COLOR	
	once	Annual	once	Annual
¼ page	\$60	\$100/2	\$75	\$130/2
½ page	\$100	\$165/2	\$140	\$240/2
Full page	\$160	\$265/2	\$280	\$480/2

ADVERTISERS: If you would like to advertise your products or services in HERBERTIA, please contact Alan Meerow. Email to: prez@bulbsociety.org. Or call at 786-412-1821.

Ad Rates:	BLACK & WHITE		COLOR	
	once	Annual	once	Annual
¼ page	\$75		\$100	
½ page	\$100		\$140	
Full page	\$160		\$280	

If you wish to run your ad in both publications, deduct 25% of the total from your order.

The opinions expressed by contributors in this publication are solely those of the individual writers and do not necessarily reflect the opinions of the editor, the board of directors, or of The International Bulb Society, Inc. (IBS). The IBS publishes paid advertisements as a service to its members but cannot be responsible for the quality of bulbs, geophytic plants, seeds, services, supplies, or other merchandise received, nor for guarantees expressed or implied.

The International Bulb Society, Inc., is a non-profit organization. Said corporation is organized exclusively for educational and scientific purposes; and especially to promote, encourage, and foster the horticulture, development, and improvement of bulbous or geophytic plants and public interest therein. These purposes are expressly limited so that IBS qualifies as an exempt organization under IRS code section 501 (c) (3).

The International Bulb Society is not formally affiliated with any other plant or bulb society. Neither IBS or its directors are liable for the actions of any such organization or its officers.

Copyright 2004 International Bulb Society – All rights reserved

ISSN 1559-8772

COVER PHOTO

Crinum scabrum x *Crinum zeylanicum* 'Fancy Pants' by David J. Lehmiller, M.D.



It hardly seems five minutes since I was writing the last Editorial, but it is in fact too long ago as we are continuing to fall behind further with our publishing schedule. My apologies for that and my New Year's Resolution is to try and catch up somewhat over the next 12 months. Hope it doesn't go the way of so many well intentioned resolutions! One thing I am very pleased with is the continuing high standard of contributions I am receiving from some quite extraordinary people who are so passionate about bulbs, whether they earn their living from them or derive pleasure from them as their hobby, and who are achieving quite extraordinary results with breeding programmes or maintaining national plant collections.

We have examples of each in this issue. The beautiful cover picture is just one of Dave Lehmill's wonderful collection of *Crinums*. His feature article, which is brim full of his own excellent illustrations, tells us about their hybridization, with insights into advanced *Crinum* hybrids. David Fenwick, who also needs no introduction to most of you and who now maintains several National Plant Collections in the UK including the one he is writing about this time – *Anomatheca* (now transferred into the genus *Freesia*). Some mouth-watering photographs of this underrated plant accompany his article.

Mark Bridgen and Eduardo Olate have written the other major article on *Alstroemeria* in Chile. Dr Bridgen is widely known for his breeding and research with *Alstroemeria*, and Dr Olate's current research includes plant tissue culture of native Chilean species with ornamental use, such as *Alstroemeria*, *Leucocoryne*, *Rhodophiala*, *Lapageria*. *Alstroemeria* cultivars have become very popular of late, so this is a subject of great interest.

Daryl Geoghegan from Australia tells us about his intriguing and successful recipe for growing many South African bulbs using 12 inch deep sand beds over clay. Proof of the pudding is in the pictures! The issue is rounded off with 3 book reviews. I hope you enjoy it and will be inspired to tell us about your own bulb ventures and experiences.

International trade in plant material

Just updating you on the current state of play in the issue of international trade in plant material. The latest I have heard from Joyce Fingerut, who co-ordinates the informal association now known as IHSEA - the International Horticulture Seed Exchange Advocacy which IBS belongs to, follows:

"The next step is that the International Plant Protection Organization (IPPC) will begin panel discussions with an eye to producing an International Standard for the movement of plants and seeds, based on NAPPO's Regional Standard ... probably sometime next year. These Standards do not have the force of law, but the signatory countries (<http://www.fao.org/Legal/TREATIES/004s-e.htm>) have agreed to bring their own legislation and regulations into compliance with Regional or International Standards. Thus, Canada, the US, and Mexico will be modifying their practices and regulations to refine and enact regulations regarding Clean Stock/Best Management Programs (see Implementation Plans, as mentioned above).

Because seeds are not produced by Seed Exchanges, but only handled by them, our societies would come under Best Management Programs. Arguably, our very seedex procedures and requirements constitute a Management Program. I have been asked, by the APHIS agent who was a US representative on the panel that drafted the Standard, whether IHSEA would be willing to pool its seedex procedures and its experiences and offer APHIS a protocol for "Best Management Practices."

For instance, the North American Rock Garden Society (NARGS) gives very specific instructions to its seed Donors, Intake Manager and Re-packagers regarding what is acceptable and/or required, in terms of seed cleanliness, identification and packaging. Having received seeds from other organizations, I am confident that all IHSEA seedexes hold to equally high levels. A protocol produced by IHSEA would communicate that fact to regulators and Standard-writers, and give us our

first opportunity to have a voice in the formulation of future regulations.”

In relation to the above Joyce has asked members to consider sharing of organizational seedex guidelines that could be combined into suggested Best Management Practices (we can all learn from each other’s examples). The guidelines can be brief and summary, or detailed and specific. Also needed would be a few volunteers to discuss and help formulate the BMP – which would then be sent out to the members for comment and correction.

Watch this space! Hopefully the two sides are moving towards regulations which are effective but

also contain a large measure of commonsense.

International regulations are only one of the things us poor bulb growers have to contend with. One of the other random factors to effect us is the weather and sadly a number of you suffered damage from the recent Northern Hemisphere hurricanes. Our thoughts are very much with you at times like that and our fingers are crossed for those of you in the Southern Hemisphere in the middle of the summer cyclone season there.

Take care and enjoy all the good things about bulb growing.

The following is a bit of advice from Mark Bridgen that I came across on the IBS forum. I thought it was worthwhile reprinting, and timely given his article on *Alstroemeria* in this issue:

Germinating *Alstroemeria* seeds is not always easy. If they are fresh seed, they will germinate faster. If not, try this:

- 1 Pour boiling water over the seeds.
This will help to crack the hard seed coat.
- 2 Leave the seeds in the water until it cools, and usually overnight.
Then, sow the seeds in typical warm conditions anywhere from 72-80F for 4 weeks.
- 3 If they have not germinated, put the moist seeds in the refrigerator for 4 weeks.
Keep them moist, but not wet.
- 4 Remove the seeds and return them to the warm conditions.
Remove seedlings as they germinate.

You may have problems with seed rot during this process. Also, due to the genetic variability, some seeds may germinate fast and some may be more recalcitrant. Be patient. As long as the seeds are firm, and not rotten, there is a chance that they will germinate.

Advanced *Crinum* Hybrids

David J. Lehmiller, M.D.

PHOTOS BY THE AUTHOR

Herbert (1837) in Amaryllidaceae provided the first definitive accounting of *Crinum* hybrids. He listed 23 interspecific (F-1) *Crinum* hybrids with which he was familiar, and his text included an additional 5 spontaneous hybrids of unknown or natural origin. Hybridization was one vehicle Herbert employed to define genera, and he apparently performed numerous crossing experiments during his lifetime. Regarding *Crinum* hybrids, he noted that some F-1 hybrids were seed sterile or rarely produced seed, whereas others were frequently seed fertile. He even commented upon the hybrid between *C.*

bulbispermum and *C. pedunculatum*, noting that it was seed fertile, and that siblings (self pollinated) resembled the parent hybrid; but if the hybrid was pollinated with *C. bulbispermum*, then the progeny bore more resemblance to *C. bulbispermum*. Herbert thus recorded the first account of an F-1 backcross.

Although *Crinum* hybrids became commercially popular about the turn of the 20th Century and were disseminated throughout the tropics and subtropical territories, almost all commercial hybrids were F-1 hybrids or F-1 backcrosses. Unfortunately, seldom was the parentage accurately documented on many of these early commercial hybrids; open pollination in the garden was the norm, and many of the attributed parents were after-the-fact speculations. Likely a few F-2 hybrids surfaced over time, but the only detailed records of F-2 and complex hybrids ever published were provided by Howard (1980, 1982), and his accounts mostly pertained to his personal experiences. It was Howard who inspired me to commence hybridizing.

General notes on interspecific hybridizing

The object behind *Crinum* hybridizing is to produce a desirable product that does not exist in nature. Other than the novelty of being unique or different, hybrids can manifest beneficial properties that may be absent or poorly expressed in the

parentage: hardiness, larger umbels, longer lasting flowers that do not droop, color enhancement, unique floral forms, greater scape yield per season, attractive or colorful leaf forms, disease resistance, etc. Also, it is possible to pursue specialty hybrids such as semi-dwarf hybrids (Figure 1.) and semi-aquatic hybrids.

The yield from attempted hybrids is quite low, but it varies from species to

species. I once tabulated the number of hybrids obtained over a six year period when utilizing *C. americanum* as the seed parent (Lehmiller 1992), and the number of actual hybrids from 686 attempted crosses was 15 or 2.3%. *Crinum moorei* is even more difficult to hybridize as seed parent than *C. americanum*, whereas *C. lugardiae*, *C. bulbispermum*, *C. variabile*, and *C. macowanii* are relatively easy as seed parents. Unfortunately some hybrid crosses yield imperfect seed that do not survive because of defective seed coats; these seed quickly succumb to bacterial rot at maturity. Other seed fail to germinate – but do not become impatient because sometimes seed can take as long as a year to germinate. I have yet to encounter a true species that “never” would accept cross (hybrid) pollination, although several (*C. jagus* and *C. campanulatum*) have yet to develop hybrid seed that have successfully germinated.

Hybrid seed are usually different in appearance from normal seed produced by the seed parent. You should be familiar with non hybrid seed, because unless you have absolute control over the fertilizing environment in your greenhouse, a stray cucumber

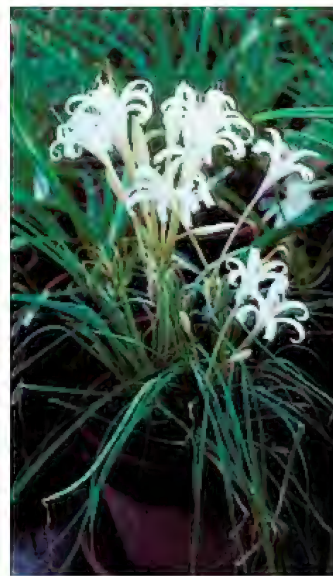


FIGURE 1. Semi-dwarf F-1 hybrid: *Crinum baumii* x *C. lugardiae*

beetle, honey bee or hawk moth can sneak about undetected and ruin the experiment. Of course, if you are limited to garden bulbs, you must de-anther the buds prior to anthesis and protect the flower from moths and bees for several days. Enclosing the flower within a paper bag via a rubber band clutching the bag about the perianth tube works well. Often times, hybrid seed are much smaller than non hybrid seed; sometimes in the order of 3mm in diameter. When the seed are small, they should be protected from drying out until germination occurs. In this case, I seal them in airtight sandwich bags along with a few drops of water and place them where they receive direct morning sunlight until germination.

Interspecific F-1 hybrids generally produce bulbs with intermediate characters and usually demonstrate few noticeable differences in progeny resulting from the same hybrid cross. However, the results are not always predictable from the flower and leaf patterns of the parent bulbs. Sometimes a desirable feature appears in the hybrid which both parents lack: for example, both *C. forbesii* and *C. macowanii* have colorful flowers that droop early in the morning following anthesis, and *C. forbesii* has long perianth tubes, but the hybrid *C. forbesii* x *C. macowanii* has flowers with short sturdy perianth tubes that persist into the afternoon heat before drooping (Figure 2). Additional examples of F-1 hybrids are demonstrated in Figures 3-11. (Note: In all hybrid formulas presented, the seed parent in the cross is listed first and the pollen parent second.)

Not all F-1 hybrids yield beneficial or pleasing results. The beautiful pigmented coloration of *C. zeylanicum* all but disappears when it is crossed with *C. bulbispermum*.

Incorporating *C. americanum* into the cross often results in a hybrid that expends most of its energy producing offsets rather than scapes, and within a few years, one bulb becomes a maze of offsets. Sometimes (rarely) freaks are produced, such as bulbs that bear flowerless (barren) scapes or scapes with stunted malformed flowers.

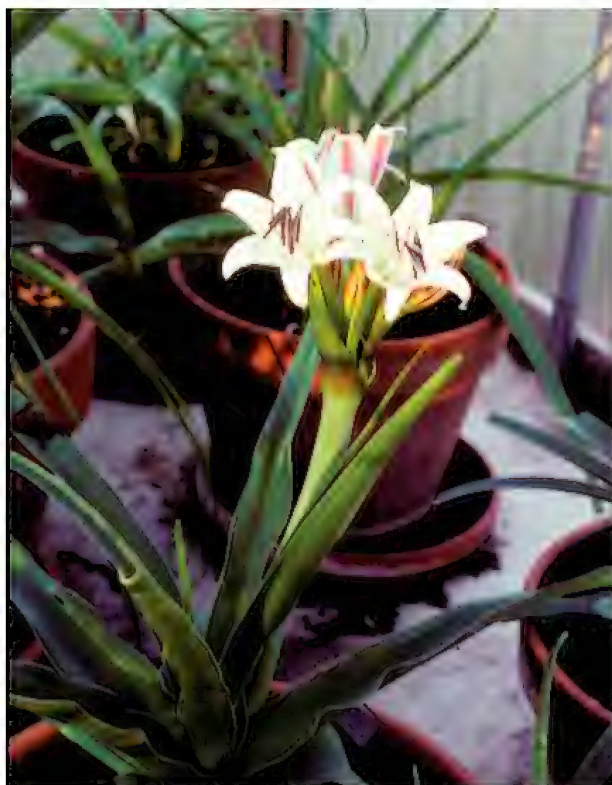


FIGURE 2. Seed fertile F-1 hybrid: *Crinum forbesii* x *C. macowanii*

Most *Crinum* species possess $2n = 22$ chromosomes. One species, *C. distichum*, has $2n = 20$ chromosomes, and one species, *C. politifolium*, has $2n = 30$ chromosomes. The number of chromosomes seems irrelevant regarding hybridizing though, as both

C. distichum and *C. politifolium* readily cross with other species as well as with each other. On one occasion, we actually performed chromosome counts, verifying



FIGURE 3. F-1 hybrid: *Crinum americanum* x *C. moorei* 'Pink Perfume'



FIGURE 4. F-1 hybrid: *Crinum paludosum* x *C. erubescens* 'Brighter Star'

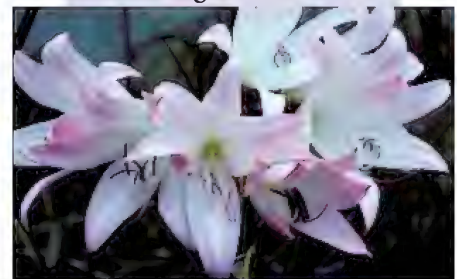


FIGURE 5. F-1 hybrid: *Crinum rautanenianum* x *C. moorei* 'Patricia Hardy'



FIGURE 6. F-1 hybrid: *Crinum paludosum* x *C. kirkii*

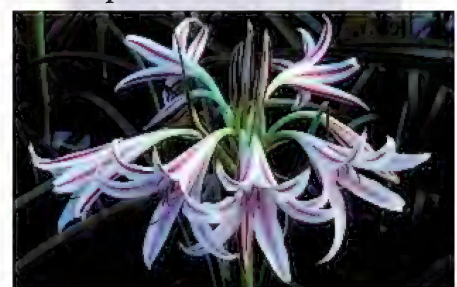


FIGURE 7. F-1 hybrid: *Crinum politifolium* x *C. lugardiae*

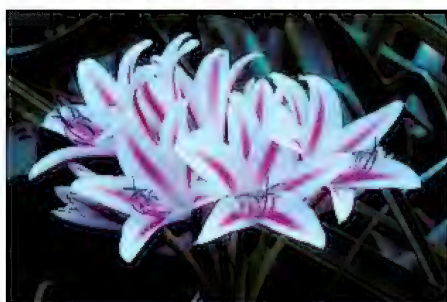


FIGURE 8. F-1 hybrid: *Crinum lugardiae* x *C. scabrum*
'Peppermint Candy II'



FIGURE 9. F-1 hybrid: *Crinum flaccidum* x *C. americanum*
'Lil' Stinker'



FIGURE 10. F-1 hybrid: *Crinum asiaticum* x *C. moorei*
'Sal Gal'



FIGURE 11. F-1 hybrid: *Crinum scabrum* x *C. asiaticum*
'Exotica'

that *C. politifolium* had $2n = 30$ chromosomes and *C. moorei* had $2n = 22$ chromosomes, and that the hybrid *C. politifolium* x *C. moorei* had $2n = 26$ chromosomes (Lehmiller, 1992). There are reports of polyploidy in *Crinum*, but scant documentation exists about the occurrence of polyploidy in man-made *Crinum* hybrids.

Several observations of note regarding F-1 hybrids and backcrosses:

- 1) To obtain hybrids with diffuse dark pink or rose colored petals, *C. moorei* must be in the pedigree (Figure 12).
- 2) Hybrids of *C. moorei*, *C. fimbriatulum*, and *C. mauritianum* produce long scapes (Figure 13.)
- 3) Hybrids of *C. kirkii* are prone to exhibit pseudocarp.
- 4) Hybrids of *C. macowanii* seldom make offsets.
- 5) Hybrids of *C. americanum*, *C. erubescens*, and *C. oliganthum* usually multiply rapidly via offsets, except when crossed with *C. macowanii*.
- 6) Hybrids of *C. macowanii* flower early in the spring, with scapes appearing just as the leaves emerge if the bulbs have been in dry dormancy.
- 7) Interspecific hybrids between species of Subgenus *Crinum* and Subgenus *Codonocrinum* are almost universally seed sterile (but not pollen sterile).



FIGURE 12. Diffuse dark-rose-colored hybrid:
[*Crinum bulbispermum* x
(*C. moorei* x *C. bulbispermum*)] x *C. moorei*
'Red Cloud'



FIGURE 13. Long scape F-1 hybrid: *Crinum variabile* x *C. moorei* 'Peyton's Place'

FIGURE 14.
Crinum
bulbispermum
x (*C. forbesii* x
C. macowanii)



FIGURE 15.
(*Crinum forbesii*
x *C. macowanii*)
x *C. acaule*

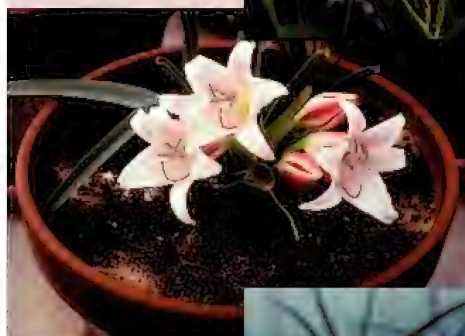
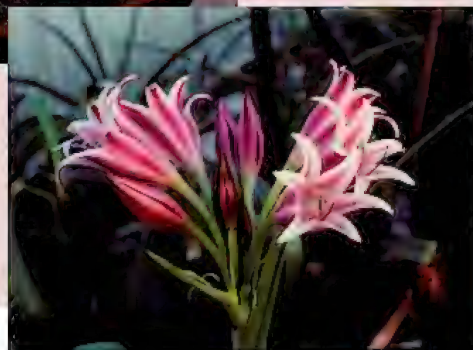


FIGURE 16.
Crinum
politifolium x
(*C. forbesii* x
C. macowanii)



Complex hybrids

To make a hybrid is not difficult. Pollen from F-1 hybrids is almost always fertile, so simply fertilize an unrelated species with pollen from an F-1 hybrid and hope for success. If you are fortunate enough to make or acquire a seed fertile F-1 hybrid, then that route is also available. Several examples of hybrids involving the F-1 hybrid in Figure 1 are illustrated (Figures 14, 15, 16). There are several F-1 hybrids which rarely function as successful seed parents, such as *C. bulbispermum* x *C. lugardiae* or *C. bulbispermum* x *C. moorei*, but consider yourself fortunate when you accomplish such a feat.

There are several ways to produce complex hybrids:

- 1) Make an F-1 backcross — backcross progeny are frequently seed fertile. An example of a

seed fertile backcross is *C. bulbispermum* x (*C. moorei* x *C. bulbispermum*) (Figure 17.). Then utilize the backcross as seed parent and cross with pollen from an unrelated species or another F-1 hybrid. Almost all pollen from F-1 hybrids is fertile.

- 2) Begin with a seed fertile F-1 hybrid such as *C. macowanii* x *C. paludosum*, *C. forbesii* x *C. macowanii*, or *C. bulbispermum* x *C. paludosum* — and cross it with pollen from an unrelated hybrid (Figure 18.).
- 3) Cross a species with pollen from an unrelated hybrid, yielding a hybrid. Frequently hybrids are seed fertile and can be used to make complex hybrids or can be pollen donors;

C. carolo-schmidtii x

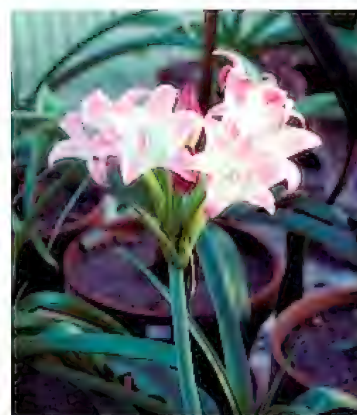


FIGURE 18. Complex hybrid:
(*Crinum forbesii* x *C. macowanii*) x 'Circus'.
(Note: 'Circus' is a T.M. Howard hybrid derived from 'Carnival' x 'White Queen')

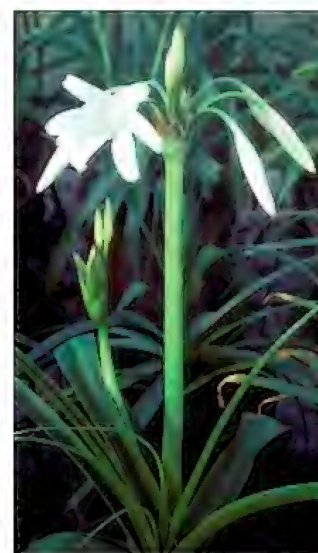


FIGURE 19. Seed fertile hybrid *Crinum carolo-schmidtii* x (*C. americanum* x *C. macowanii*)

FIGURE 20.
Flower detail of hybrid in Figure 19.



FIGURE 21. Complex hybrid involving hybrid in Figures 19 and 20: [(*Crinum forbesii* x *C. macowanii*) x *C. flaccidum*] x [*C. carolo-schmidtii* x (*C. americanum* x *C. macowanii*)]

FIGURE 17. F-1 backcross:
Crinum
bulbispermum x
(*C. moorei* x
C. bulbispermum)
'Norma Justine'



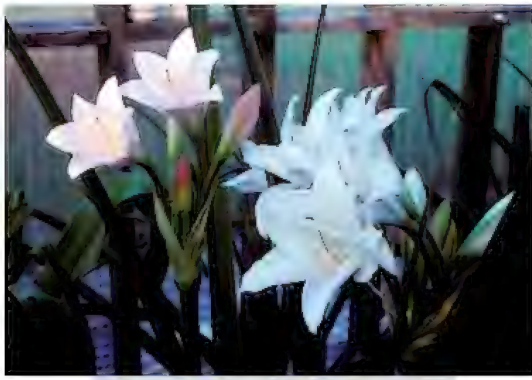


FIGURE 22. Complex hybrid offspring grown from seed originating from the same fruit: [*Crinum bulbispermum* x (*C. moorei* x *C. bulbispermum*)] x *C. paludosum*



FIGURE 23. Complex hybrid from same hybrid fruit as Figure 24: {[*Crinum bulbispermum* x (*C. moorei* x *C. bulbispermum*)] x *C. paludosum*} x {*C. forbesii* x *C. macowanii*}



FIGURE 25. Complex hybrid: {A x B} x {C} (cv. 'Five Star')

(*C. americanum* x *C. macowanii*) is an example of a seed fertile hybrid (Figures 19, 20, 21).

The results of complex hybridizing experiments are not predictable. Oftentimes all progeny of a hybrid from the same fruit will appear similar, and if the experiment is repeated at a later date utilizing the exact same parent bulbs, the resultant progeny will often appear similar to the original cross. Any differences are usually noted in floral pigmentation. However, substitute into the hybrid equation an identical species but one collected from a distant locality, and the "same" hybrid may be somewhat or even strikingly different. In contrast, seeds from the same fruit of a complex hybrid usually yield vastly different progeny, especially in the floral form and floral pigmentation (Figures 22, 23, 24).

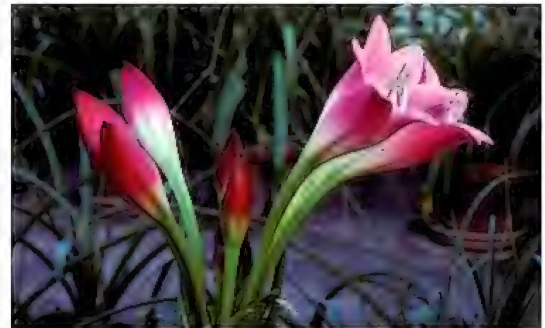


FIGURE 24. Same complex hybrid as Figure 23 but from a different seed

So the question arises: What is the ultimate goal in hybridizing? I don't have a good answer. It is just plain fun, and perhaps it is addictive. When you mix together the ingredients to produce a complex hybrid, you cannot even speculate about the outcome. The results always come as a complete surprise. For example: the following complex hybrid has the formula {A x B} x {C} with the former as seed parent. The ingredients are:

A = [*C. bulbispermum* x (*C. moorei* x *C. bulbispermum*)] — pink flowers (Figure 17.)

B = [*C. graminicola*] — dark pinkish purple striped flowers

C = [*C. rautanenianum* x *C. moorei*] — light pinkish flowers (Figure 11.)

The resultant complex hybrid has large, beautiful, pure white flowers (Figure 25.), something totally unexpected. I am fortunate to have acquired a large collection of species, including several recent ones with unusual floral forms – so I have new ingredients to add to the pot, and who knows what might come forth. Perhaps someday there will be a double-flower *Crinum* hybrid.

Bibliography

1. Herbert, W. 1837. *Amaryllidaceae*. J. Cramer Reprint, 1972, Lehre.
2. Howard, T.M. 1980. Advances in *Crinum* breeding. *Herbertia* 36:86-92.
3. Howard, T.M. 1982. Advances in *Crinum* breeding (Part II). *Herbertia* 38:78-86.
4. Lehmiller, D.J. 1992. Interspecific hybrids of *Crinum americanum* L. (*Amaryllidaceae*). *Acta Hort.* 325:591-596.

Alstroemeria of Chile

Mark P. Bridgen &
Eduardo A. Olate

ALL PHOTOS BY THE AUTHORS

Introduction

Commercial cultivars of *Alstroemeria*, also known as the Lily-of-the-Incas, Peruvian Lily, or Inca Lily, began to gain popularity in the 1970's, primarily as a cut flower crop. In recent years, hybrid cultivars have been grown as garden flowers and as potted flowering plants. The plants produce beautiful, large inflorescences of many different colors including purple, lavender, red, rose, pink, yellow, peach, orange, white and bicolors. In addition to their showy colors, the cut flowers have long postharvest vase lives up to 2-3 weeks. When commercial *Alstroemeria* hybrids are grown properly, the plants have an everblooming flower habit. New flowering stems are continuously produced from underground rhizomes after the requirements for flower initiation have been met. All of these valuable characteristics have made hybrid *Alstroemeria* very popular.

Native species of *Alstroemeria* exist in several South American countries including Chile, Brazil, Peru, and Argentina with the greatest diversity of species existing in Chile. These Chilean species are indigenous to a variety of habitats including the snowline of the Andes Mountains, coastlines of the Pacific Ocean, highland and temperate forests, and the Atacama Desert. Despite their rich diversity, the native species are of little commercial value because many of the plants go dormant for part of the year, the flowers are often small and insignificant, and the postharvest life is not always optimal.

Chile is located in the southwest corner of the South American continent and bordered by Peru to the north, Bolivia and Argentina to the east, the South Pole to the south and the Pacific Ocean to the west. Chile is a very long (4,200 km) and narrow country; nearly as long as the USA is wide. At its widest point, this diverse country is only about 240 km. The climates of Chile are very diverse: the northern part of Chile has the hot, dry Atacama Desert, the central part has Mediterranean-like weather, the southern part of Chile is cool and moist, and the most southern region is bitter cold. With oceans on the western and southern sides, the Andes Mountains reaching as high as 6,500 meters to the east, and a desert to the north, Chile evolved as an isolated botanical wonder with tremendous genetic diversity. Chile's geographical isolation has permitted the development of unique genera that do not exist anywhere else in the world.

The genus *Alstroemeria*

The genus *Alstroemeria* was first described by R.P. Louis Feuillet in 1714, but was named by Carolus Linnaeus in honor of Klas von Alströemer who took the first seeds from South America to Europe. The genus belongs to the subclass Monocotyledonae (monocots) and is a petaloid monocot in the superorder Liliflorae. In earlier years, *Alstroemeria* belonged to the Amaryllidaceae and Liliaceae families; however, now it is in the Alstroemeriaceae. The Alstroemeriaceae family includes two other genera, *Bomarea* and *Leontochir*. Some botanists consider *Schickendantzia* and *Taltalia* as different genera in Alstroemeriaceae, but the most recent taxonomic information considers these to be members of the genus *Alstroemeria* (Sanso and Xifreda, 2001).

Alstroemeria are herbaceous, geophytic plants that produce two types of shoots: floral and vegetative. Shoots are initiated on subterranean rhizomes that can grow as long as 120 cm (4 feet) or as short as 15 cm (6 inches). A fibrous root system develops from the *Alstroemeria* rhizome and the roots can become thickened storage roots as the plant develops giving the incorrect impression of a tuberous root. Leaves on the shoots are called resupinate because their leaf base twists 180° so the top surface (adaxial surface) faces down.

Flowers of *Alstroemeria* are irregular shaped (zygomorphic) with inferior ovaries; flowers arise in a terminal bracted umbel of cymes. Each cyme bears one to five sympodially arranged flower buds. The

perianth consists of six uniform tepals that open simultaneously. Mature blooms are funnel-shaped with their tepal tips curling outward. The sexual parts of the flower are dichogamous with the stamens opening and shedding their pollen before the stigma becomes receptive. The dichogamy is so pronounced that the age of the flower can be predicted by observing this phenomenon.

Alstroemeria species of Chile

The most recent taxonomic report for *Alstroemeria* indicates that there are approximately 33 species throughout Chile with 8 subspecies and 8 varieties (Muñoz and Moreira, 2000). The species are distributed throughout the country between 20° and 53° south latitude. However, the greatest diversity is concentrated in the central part of the country, which has a Mediterranean climate, between 28° and 37° south latitude.

Alstroemeria aurea



FIGURE 1. *Alstroemeria aurea* Graham.

A. Orange form with seed pods.
B. Yellow form.



aurea is one of the easiest of the *Alstroemeria* species to cultivate and can be found in many gardens in regions where they can tolerate cold (as cold as USDA zone 5). The original name for this species was *A. aurantiaca*.

Alstroemeria aurea Graham (Figure 1) is one of the most common *Alstroemeria* species found in the forests of southern Chile. The flowering stems and vegetative shoots are often 90-120 cm (approximately 3-4 feet) in length. Flowers are small (2.5-4 cm wide) with yellow, orange, and orange-red colors. A.

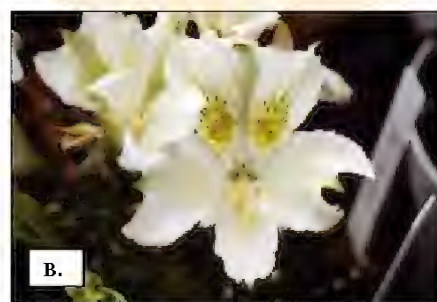
Alstroemeria pelegrina

Alstroemeria pelegrina L. (Figure 2) is a very showy *Alstroemeria* that is found along the coast in central Chile north of Santiago (32° S). Plants can reach 60 cm (2 feet) in height and have large and showy flowers 5-7.5 cm (2-3 inches) wide. Flowers are typically bright pink, but there is a rare white-flowered form (Fig 2B).

The leaves of this species are especially waxy probably due to the harsh ocean environment in which they live. This species was commonly used by the first breeders of hybrid *Alstroemeria* because of the ease of seed set. It is endangered because of development in locations where it naturally exists. *A. pelegrina* is especially tolerant to salt water and could be used to breed salt-tolerance into hybrids.



FIGURE 2. *Alstroemeria pelegrina* L.
A. Common pink form
B. Rare white form
(*A. pelegrina alba*)



Alstroemeria werdemannii

A. werdemannii Bayer (Figure 3) is a desert species that grows well in very sandy soils along the coastal areas of northern Chile. This species has short internodes with fleshy, waxy leaves that are blue-green colored. Shoots are erect, not decumbent and plants are



FIGURE 3.
Alstroemeria werdemannii growing in the Atacama Desert, Chile.
A. *Alstroemeria werdemannii* var. *werdemannii*



FIGURE 3.
Alstroemeria werdemannii growing
in the Atacama Desert, Chile
B. *Alstroemeria werdemannii*
var. *flavicans*.

yellow (Figure 3B). This species has very extensive root systems due to the harsh, dry environment in which it exists. *A. werdemannii* has a restricted distribution in its native habitat.

Alstroemeria ligtu

A. ligtu L. (Figure 4) was previously known as *A.*

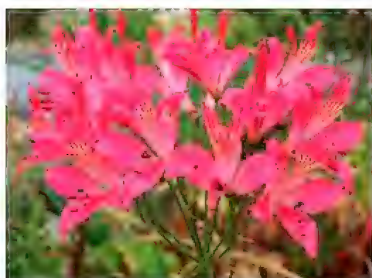
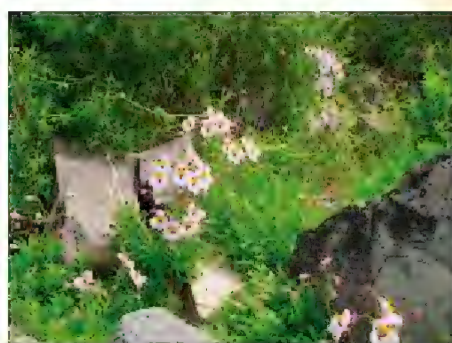


FIGURE 4. *Alstroemeria ligtu*

in the east. *A. ligtu* grows tall to a maximum of 150 cm tall (60 inches); its long stem length makes it a good native cut flower. However, its foliage is linear and can be unattractive; by the time the plants flower, most of the stems have minimal attractive leaves present. Flowers of *A. ligtu* L. are not as open as most other *Alstroemeria* species and the tepals are more linear. Flowers from this species are small but colorful in pastel colors of dark orange, red, pink and white. *A. ligtu* tolerates a broader range of temperatures for successful growth and blooms in the middle of the summer.

haemantha R. This species of *Alstroemeria* is widely distributed in Chile from Valparaiso in the north to Concepcion in the south and from the coastal regions in the west to the Andes Mountains



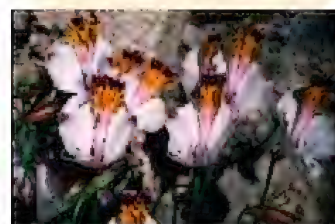
short (40 cm). Flowers are smallish approximately 2.5-3.0 cm wide (1 inch). Flowers of *A. werdemannii* Bayer var. *werdemannii* are pink (Figure 3A) and flowers of *A. werdemannii* var. *flavicans* M. Muñoz are

Alstroemeria pulchra

A. pulchra Sims (Figure 5) is one of the most common *Alstroemeria* species in central Chile and is not endangered. This species grows in a wide range of Chilean environments from the ocean to the desert to the mountains. Plants are very vigorous and grow well in stony soils in full sun. Stems are as long as 100 cm (40 inches) in length. Flowers bloom in the spring with colors ranging from pink to pale pink to almost white. Seeds set well on these plants. *A. pulchra* looks very similar to *A. magnifica* and it can be difficult to distinguish the two species apart.



FIGURE 5.
Alstroemeria pulchra



Alstroemeria magnifica

A. magnifica Herbert (Figure 6) is often confused with *A. pulchra*. *A. magnifica* grows in the La Serena region of Chile along the coast in rocky regions and shares a habitat with *A. pulchra*. Natural



FIGURE 6.
Alstroemeria magnifica

interspecific hybridization probably occurs between the two species, which adds to the difficulty identifying the plants. *A. magnifica* has the largest and showiest flowers of the genus, approximately 8-10 cm wide (3-4 inches). Flower stems are often very long and are commonly supported by some other

vegetation. Leaves on the flowering stems are scarce. Flowers are shades of purple, from pale lavender to dark purple.

Alstroemeria pseudospathulata

A. pseudospathulata Bayer (Figure 7) is a very



FIGURE 7.
Alstroemeria pseudospathulata

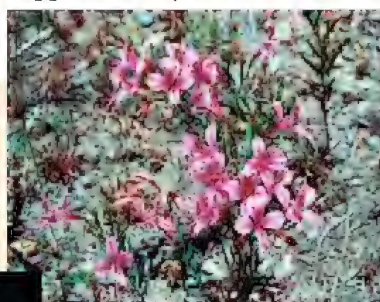
short *Alstroemeria* that only grows up to 30 cm tall (12 inches). This species grows in a very restricted area of Chile and is endangered. *A. pseudospathulata* thrives in full sun in rocky soils very high in the Andes Mountains as far as 2,000 meters above sea level. The foliage of *A. pseudospathulata* is very thick and a bluish green color. The plants flower in the summer and have brilliant yellow flowers. Although *A. pseudospathulata* plants are much smaller than *A. aurea* plants, they have similar sized flowers. *A. pseudospathulata* are good alpine plants and very winter hardy.



Alstroemeria presliana

A. presliana (Figure 8) is another species that grows in high altitudes approximately 1,500-2,000

FIGURE 8.
Alstroemeria presliana



meters above sea level. They can be found in the Los Andes mountain range or the coastal mountain range. The plants flower in the summer with small, pink/

lavender flowers that have 2-6 florets per umbel. The foliage of *A. presliana* is sessile and linear and plants reach a height of no more than 40 cm (16 inches).

Breeding *Alstroemeria*

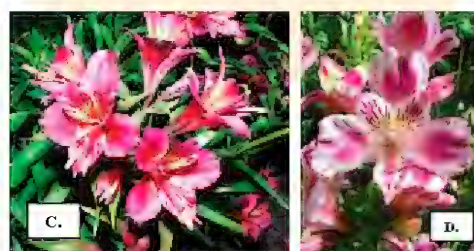
The diverse and colorful genera of *Alstroemeria* create a tremendous potential for the breeding of new hybrids. Their protandrous flowers prevent self pollinations and naturally encourages cross pollinations. Our breeding work since 1987 has demonstrated that *in vitro* embryo rescue is often needed for interspecific hybridization to be successful. The protocol that we use is relatively easy. *In ovulo* embryos can be aseptically removed from hybrid ovaries approximately 7-20 days after pollination. They should be aseptically cultured on ¼ strength Murashige and Skoog (MS) salts and vitamins (1962) with no growth regulators and placed in the dark at 18°C until germination.



FIGURE 9.

Alstroemeria cultivars.

A. 'FreedomP' B. 'Sweet LauraP'
C. 'Mauve MajestyP' D. 'LibertyP'



Germination may occur quickly, or it may take several months. After germination, seedlings can be subcultured onto full strength MS medium with 2 mg benzylaminopurine (BA) per liter and no agar until they reach a suitable size to be removed from culture. This protocol can also be used to obtain sterile triploids and tetraploids ($2n = 4x = 32$) (Lu and Bridgen, 1997). Cultivars that have been introduced from this breeding program include 'FreedomP', 'LibertyP', and the only fragrant cultivar in the world, 'Sweet LauraP'. The newest, winter-hardy cultivar to be introduced in 2006 is 'Mauve MajestyP' (Figure 9). Our breeding program with

Alstroemeria has been successful during the past 18 years because of the generous funding by the American Floral Endowment, the Gloeckner Foundation, and Cornell University.

Literature

Bridgen, M. 2001.

A nondestructive harvesting technique for the collection of native geophyte plant species. *Herbertia* 56:51-60.

Bridgen, M. 2000.

Mejoramiento genético del género *Alstroemeria*. pp. 55-63. IN: P.

Peñailillo B. and F. Schiappacasse C. (Eds.) Los Neófitos Nativos y Su Importancia en la Floricultura. Universidad de Talca. Talca, Chile.

Bridgen, M.P. 1997.

Alstroemeria. IN: V. Ball, ed., Ball Red Book, 16th ed., pp. 341-348, Geo. J. Ball Publishing Co., W. Chicago, IL.

Bridgen, M.P. 1994.

A review of plant embryo culture. *HortScience* 29(1):1243-1246.

Bridgen, M.P. 1993.

Alstroemeria. pp. 201-209. IN: A.A. DeHertogh and M. LeNard (Eds.)

The Physiology of Flower Bulbs - A Comprehensive Treatise on the Physiology and Utilization of Ornamental Flowering Bulbous and Tuberous Plants. Elsevier Publishing.

Bridgen, M.P., J.J. King, C. Pedersen, M.A. Smith, and P.J. Winski. 1991.

Micropropagation of *Alstroemeria* hybrids. Proceedings of the International Plant Propagator's Society, Vol. 41:380-384.

Bridgen, M.P., E. Olate, and F. Schiappacasse. 2000.

Flowering geophytes from Chile. IN: G. Littlejohn, R. Venter, and C. Lombard (Eds.) Proceedings of the Eighth International Symposium on Flowerbulbs. 570:75-80.

Chiari, A. and M.P. Bridgen. 2000.

Rhizome splitting: A new micropropagation technique to increase in vitro propagule yield in *Alstroemeria*. *Journal of Plant Cell, Organ and Tissue Culture*. 62:39-46.

Hoffmann, A.E. 1989. Chilean monocotyledonous geophytes – taxonomic considerations and their state of conservation. *Herbertia* 45 (1 & 2):13-29.

King, J.J. and M.P. Bridgen. 1990.

Environmental and genotypic regulation of *Alstroemeria* seed germination. *HortScience* 25(12):1607-1609.

Lu, C. and M.P. Bridgen. 1997.

Chromosome doubling and fertility study of *Alstroemeria aurea* X *A. caryophyllaea*. *Euphytica* 94: 75-81.

Lu, C. and M.P. Bridgen. 1996.

Effects of genotype, culture medium, and embryo developmental stage of the *in vitro* responses from ovule cultures of inter-specific hybrids of *Alstroemeria*. *Plant Science* 116:205-212.

Muñoz, M. and A. Moreira. 2003.

Alstroemerias de Chile. Diversidad, Distribucion y Conservacion. Gobierno de Chile. Consejo Nacional del Libro y La Lectura. Santiago, Chile. 140 pp.

Murashige, T. and F. Skoog. 1962.

A revised medium for rapid growth and bioassays with tobacco tissue cultures. *Physiol. Plant.* 15:473-497.

Olate, E., Ly, D., Elliott, G. and Bridgen, M.P. 2000.

Influence of the timing of propagation and cold storage on the growth and development of *Alstroemeria* pot plants. Proceedings of the International Plant Propagators' Society. 50:379-391.

Sanso, A.M. and C.C. Xifreda. 2001.

Generic delimitation between *Alstroemeria* and *Bomarea* (Alstroemeriaceae). *Annals of Botany* 88:1057-1069.

Table 1.

Species of *Alstroemeria* in Chile

A. achirae
A. andina
A. andina venustula
A. angustifolia
A. angustifolia velutina
A. aurea
A. crispata
A. cummingiana

A. diluta
 A. diluta diluta
 A. diluta chrysantha
A. exerens
A. garaventae
A. graminea
A. hookeri
 A. hookeri maculata
 A. hookeri recumbens
A. kingii
A. leporina
A. ligtu
 A. ligtu incarnata
 A. ligtu simsii
A. lutea
A. magnifica
 A. magnifica magenta
 A. magnifica sierrae
 A. magnifica tofoensis
A. mollensis
A. pallida
A. patagonia
A. pelegrina
 A. pelegrina alba
A. philippii
 A. philippii albicans
A. polyphylla
A. presliana
 A. presliana australis
A. pseudospathulata
A. pulchra
 A. pulchra lavandulacea
 A. pulchra maxima
A. revoluta
A. schizanthoides
 A. schizanthoides alba
A. spathulata
A. umbellata
A. versicolor
A. violacea
A. werdermannii
 A. werdermannii flavicans
 A. werdermannii
 werdermannii
A. zoellneri

Mark Bridgen

Dr. Mark Bridgen is a Professor of Horticulture at Cornell University and serves as Director of the Long Island Horticultural Research and Extension Center. Dr. Bridgen's areas of expertise include floriculture and ornamental horticulture, plant propagation, herbaceous ornamental plants, and plant tissue culture and micropropagation. Dr. Bridgen has received several awards during his 21 years in academics; he was chosen as a Fulbright Fellow in 1999 and has also received the Excellence in Teaching Award and the Faculty Adviser Award. Mark has published more than 130 publications and is widely known for his breeding and research with *Alstroemeria*, the Lily-of-the-Incas. Dr. Bridgen's breeding research focuses on the geophytes of Chile and now includes projects with *Leucocoryne*, *Rhodophiala*, *Conanthera*, and *Zephyra*.



Dr. Mark Bridgen
 Professor and Director
 Cornell University
 3059 Sound Avenue
 Riverhead, NY 11901
 Tel: 631-727-3595
 Fax: 631-727-3611
 E-Mail: mpb27@cornell.edu
 Website: www.LongIslandHort.cornell.edu

Eduardo A. Olate

Dr. Eduardo A. Olate is an Assistant Professor in the Department of Plant Science at the Pontificia Universidad Catolica de Chile. His current research includes plant tissue culture on native Chilean species with ornamental use, such as *Alstroemeria*, *Leucocoryne*, *Rhodophiala*, *Lapageria*, and others. Dr. Olate teaches graduate classes in Plant Tissue Culture and Plant Biotechnology. He teaches undergraduate classes in Commercial Production of Cut Flowers and Ornamentals, Plant Propagation, and Greenhouse Design and Management. Eduardo was a graduate student under the guidance of Mark Bridgen; the two of them have traveled throughout Chile extensively to study the native flora.



Dr. Eduardo A. Olate
 Department of Plant Science
 Pontificia Universidad Catolica de Chile Santiago, Chile
 Phone: 011.56.2.354.4119
 Fax: 011.56.2.552.0780
 Email: eolate@uc.cl

NCCPG National Plant Collection[®] of Freesia (*Anomatheca*)

By David Fenwick

Freesia (*Anomatheca* Group)

Transferred to *Freesia* from *Anomatheca*

by Dr. Peter Goldblatt

I first discovered these plants about ten years ago and just shortly after I started collecting *Crocasmia*. Over the next couple of years I obtained six plants. These were *Freesia laxa*, *Freesia laxa* ssp. *azurea*, *Freesia laxa* 'Alba' *Freesia laxa* 'Joan Evans', *Freesia viridis* and *Freesia grandiflora*; all of which, with the exception of *Freesia grandiflora*, were what I thought were winter rainfall species in South Africa. However this was far from true and I later discovered that *Freesia laxa* comes from both winter and summer rainfall areas.

Originally all the *laxa* types were grown under cover as winter rainfall species. All flowered here during Chelsea Week in May with the exception of *F. l.* subsp. *azurea* which flowers a little earlier. I discovered their suitability as summer flowering bulbs on sowing a little seed in the middle of January one year, as this is the time I usually start sowing all sorts of bulb seed. Rather amazingly to me at that time, I discovered they only took six months from sowing to flowering. This intrigued me so I decided to look at them in a little more detail as it was obvious that they had far more horticultural value than I first thought.

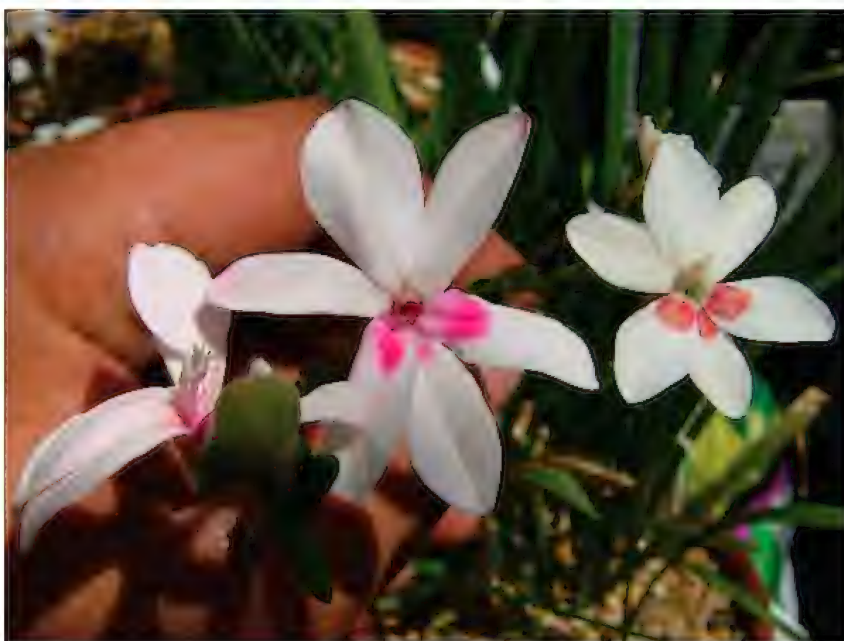
On researching them more I discovered that they were very closely related to another genus I was collecting and researching, namely *Crocasmia*. One question had stuck in my mind for ages – could *Freesia laxa* be used to discover how and why so many different *Crocasmia* hybrids were bred in such a short space of time in the late 19th Century?

Victor Lemoine of Nancy, France was responsible for breeding the common montbretia, *Crocasmia x crocosmiiflora* around 1879 – a cross

between *Crocasmia aurea* and *Crocasmia pottsii*, then called Montbretia. Lemoine went on to breed a further 55 hybrids until 1908, although most were bred before 1900.

Anomatheca would make a good study as this group had not really been hybridised before and the only problem I would have if I were to compare *Anomatheca* breeding to *Crocasmia* breeding, is in making an inter-specific hybrid, or in "finding one". I've always thought myself a lucky person and whilst crossing *F. grandiflora* with *F. laxa* I also decided to attempt a cross of *F. laxa* subsp. *azurea* with a plant I obtained as *Lapeirousia* 'Naticoke'. The former never produced any seed at all, but the latter did. I then had to find out more about *Lapeirousia* 'Naticoke'.

'Naticoke' came to me from the Reed's Garden in



Freesia 'Shelley'

East Devon, UK; the only information passed to me at that time was that it was an American hybrid. I have never since found out any more information about this hybrid, even on joining the IBS several years ago. However I am now nearly 100% certain

that because of the expected behaviour of its progeny in breeding, 'Naticoke' is indeed *Freesia laxa* x *Freesia grandiflora*,

The first cross between *F. laxa* subsp. *azurea* and 'Naticoke' gave rise to a very distinct hybrid, *F. 'Plum Scrumptious'*, named for its very deep plum coloured central markings. The most recognisable feature of this plant however, is that the ground colour is white but becomes suffused with pink and lilac towards the end of its segments.

My very first attempt at *Anomatheca* breeding was in crossing *F. laxa* with *F. l. 'Alba'* to try and achieve a pure pink, as one would expect to get a pink by crossing a red flower with a white one. The normal colour of the progeny of this cross is white with red central markings. In the UK these are represented by the form *F. l. 'Joan Evans'*. However one percent of this cross did turn out pink and one of these was selected, grown on, and later named *F. l. 'Sunset Boulevard'*. This hybrid was subsequently used in crossings with 'Plum Scrumptious', and has recently produced a uniformly coloured lilac *laxa* type hybrid, which I have named 'East of Eden'.

The latest hybrid of merit to be selected is *F. 'Shelly'*. This came as quite a shock as it arose after selfing 'East of Eden' – a shock for I have found *F. laxa* hybrids usually come fairly true from seed if selfed. Thus different rules do apply after an interspecific has been produced and backcrosses are thus more likely to vary. This was the information I was looking for regarding early *Crocasmia* production and the reason why Lemoine produced so many hybrids in such a short space of time.

Plant Listing

Freesia laxa syn. *Lapeirousia cruenta* and *Anomatheca laxa*

Variable in colour in the wild with salmons, pinks, whites and reds occurring naturally. These also naturalise and will produce plants similar to the hybrid below, 'Joan Evans'. The species occur both in the summer and winter rainfall areas of South Africa. Thus in the northern hemisphere the species can be grown under glass for flowering in May or in the garden for flowering from late June. This species



Freesia laxa 'Joan Evans'

can also be grown as an annual as it can flower from seed in just 5-6 months. Because of this it is now being grown commercially in large amounts and is frequently seen offered in Garden Centres in the UK. But it is also grown in colder climates, and in places such as Canada, as an annual. Here I let it seed and naturalise itself throughout the garden.

Freesia laxa 'Joan Evans'

White with red markings, this is a hybrid of *F. laxa* with *laxa* 'Alba'; this plant is also circulating erroneously as *Anomatheca divaricata*, which is non-legit, and the implied *Laperousia divaricata* is completely different. If selfed and grown from seed, plants produced are variable in marking, and the red markings can be smaller and less pronounced.

Freesia laxa subsp. *azurea*

A pale lilac blue form which flowers earlier, but is slightly weaker than the rest for some reason. Best treated as a greenhouse plant in the UK as it is less hardy than *F. laxa*.

Freesia laxa 'Alba'

Pure white form of the species with no markings. For me here I consider it less hardy than *F. laxa*.

Freesia laxa (cream form)

Bred by Phil Waterman, Plymouth, Devon, UK.
Cream form of the species without markings.

Freesia laxa 'Rainbow Hybrids'

Bred by Don Rix, Pine Heights Hippy's, Queensland, Australia. Shorter plants than the UK strain but these don't bleach much in the sun. Colours range from plants like 'Joan Evans' to a really nice pale pink. Recommended garden plant for climates a little warmer than mine.

Freesia laxa 'Sunset Boulevard'

Bred by myself. A pure pink form of *laxa*, bred here by crossing *Freesia laxa* with *F. l.* 'Joan Evans'. As hardy as *laxa* here.



Freesia laxa
'Star of David'

Freesia laxa 'Sunset Giant Pink'

Bred by collection holder. Sadly now lost but this was another cross from *Freesia laxa* with *F. l.* 'Joan Evans', but has to be mentioned here for the plant was over 2 feet tall.

Freesia laxa 'Star of David'

A hybrid 'found' in the garden here, I also frequently see it being offered elsewhere as *Freesia*. or *Anomatheca laxa*. It is a pinky red form of *laxa*. A dwarfer plant with starry, bi-symmetrical flowers. It is also quite hardy here.

Freesia
laxa



Freesia laxa x *grandiflora* 'Naticoke'

Origin Unknown. Potentially an inter-specific hybrid between *F. laxa* and *F. grandiflora*. It has intermediate features from both parents. Early to flower, and at the same time as *Freesia laxa* subsp. *azurea*. Flowers, of a pinky-lilac with deep purple markings.

Freesia laxa 'Alba'





Freesia laxa 'Sunset Boulevard'

Freesia (*laxa* x *grandiflora*) x *laxa* 'Plum Scrumptious'

Bred by collection holder. Bred here of 'Naticoke' and *Freesia laxa* subsp. *azurea* parentage. A white with pink tips with plum markings.

Freesia ((*laxa* x *grandiflora*) x *laxa* 'Plum Scrumptious') x *laxa* 'East of Eden'

Bred by myself. A completely new colour for a *F. laxa* backcross. Lilac flowers, bred here three years ago.

Freesia laxa 'Shelly' (*F.* 'East of Eden' x *F.* 'East of Eden')

Bred by myself. A very large white, probably the largest flowered *Anomatheca*, with rose markings. Named after a friend of the family, Shelly Driscoll, a very large, single lady who readily blushes.



Freesia laxa 'Shelley'

Freesia viridis

A winter rainfall species producing larger much rounder corms than *F. laxa*, and bearing spidery yellowy-green flowers in late spring.

Freesia viridis var. *crispa*

Very similar to the above but with undulating leaf margins.

Freesia grandiflora

The only summer rainfall species of the *Anomatheca* Group, producing larger red flowers about the size of a two pence piece. Flowers in July here.



Freesia 'East of Eden'

Sand/Clay – The preferred medium?



By Daryl Geoghegan

ALL PHOTOS BY THE AUTHOR

I remember my excitement when I discovered the Amaryllids of South Africa. Like many gardeners in my country, very few of us knew of these strap leaved plants with big colourful blooms. My first seeds to arrive from South Africa were *Brunsvigia gregaria*. I was experimenting at the time with growing seeds and bulbs under lights in boxes of pure sand as I had read that the less vegetative matter in the soil the less chance of disease and rot. This seed germinated rapidly producing a leaf and roots.

After babying these seeds, checking them 4 times a day and reading more on the subject, I was hooked! That was 9 and 1/2 years ago and many 1000's of seeds have since been germinated under my care.

As bulbs are nature's adaptation to poor soils, the main focus for success in growing amaryllidaceous bulbs was a concentrated effort to figure out in what type of soil these bulbs will grow and flower well. I have read many folks explanations of what soil PH to have, what fertilizers to use, and how much sun/shade, etc. to provide. It can be stated that the really gifted growers/collectors understand what is needed to obtain excellent results from any collection. That is, they understand the plants requirements. This is fundamental for keeping your collection not only alive, but thriving. This enables you to produce seeds and offsets to expand and disseminate your collection.

During the last two years my wife and I obtained a small 3.5 acre property at Barnawartha, in the state of Victoria, Australia. When I first looked at the property I had no idea of the soil content and reasoned that I would buy in the soil needed to cultivate the bulbs here. As our land is on the flats, our horizon is unobstructed and our sunlight intensity is far greater than my previous block in town. I had the entire collection in pots but wanted to get it into the ground ASAP as the sun was boiling the bulbs

in the black pots. I dug beds in the paddock after softening the soil, and to my surprise the soil was a sandy/clay with a very high percolation rate (how fast the water runs through the soil), yet it was dense and hard as a rock, not soft at all until it was watered.

I planted all of my bulbs straight into the paddock in full sun, watering every three days during the summer months. The bulbs grew the best I had ever seen them grow. Root and leaf growth was at least 3–4 times faster than before and it has been a great delight to see the bulbs do so well in the paddock soil. I have since found out that this property was a dairy farm 120 years ago and has





Bulbinella triquetra



Lachenalia orthopetala



Naraya polystachya

been grazed over from then until now. Our climatic conditions (wet/freezing winters and hot/dry baking summers) are the toughest I have ever grown bulbs in and they love it! It has become clear to me that I had not really experienced excellent cultivation in town using the methods I was using. In reality, I was dreaming. At this new place the majority of my bulbs are in the same soil, same position and get the same amount of water. Included in the bulbs that I grow in the open are *Crinum* species, *Boophone*, *Ammocharis*, *Nerine*, *Hippeastrum* and rainlilies. Accompanying bulbs like *Eucomis*, *Iris*, *Alstromeria* and *Lilium* also do well in the full sun.

My winter growing collection is in pure sand on clay. The sand is at least 30cm (12 inches) deep and all the winter growers rest on a bed of clay. Many species love this type of cultivation. *Haemanthus*, *Gethyllis*, *Hessea*, *Strumaria* and *Brunsvigia* species that come from winter growing climates have responded very well to deep sand cultivation. Although the sand is deep, some consideration is needed to figure out the amount of summer water required. If the sand is too deep, many of the bulbs will perish in my area due to the extreme summer heat which dries up the soil too much. This is where the clay comes into action. As the sand dries, it maintains a dry area around the bulbs, whilst the clay enables the bulbs to obtain some moisture during the dormant period. I have dug up the bulbs during this period to discover that the roots have firmly grown into the clay below, anchoring the bulb and sustaining them too. This season I have planted corn over the bed to shade them better during the really hot months. We all love fresh corn on the cob!

Having the two growing media described above does not replace the need to raise some seeds in pots. As my environment can be at times very unforgiving, I still raise certain seeds under cover. Once these are old enough, I plant them out in the paddock and they do well.

It has been my pleasure to share this information with you. I share all my information/seeds/bulbs online at www.mainlyamaryllidsgarden.com

Daryl Geoghegan.



*Babiana
dregei*



*Babiana
vanzylliae*



*Ferraria
divaricata*

Book Reviews

BULBS FOR GARDEN HABITATS

Judy Glattstein. Timber Press, Inc., Portland, OR.

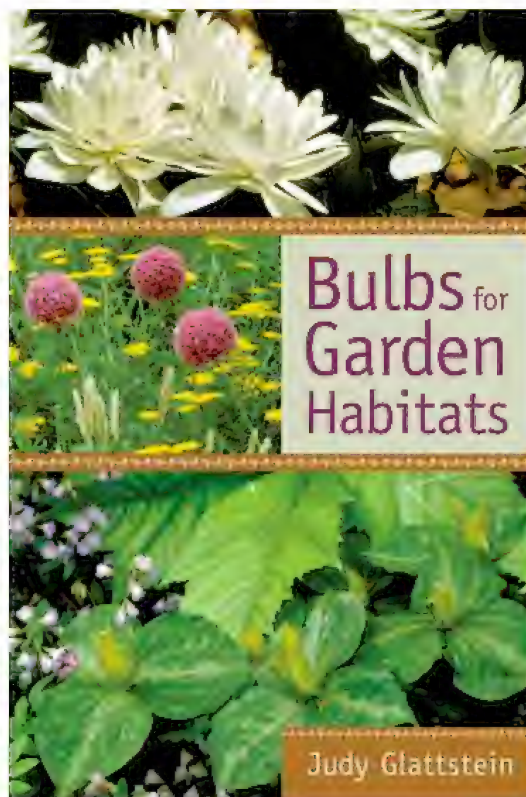
Hardcover, 296 pp, color photographs..\$29.95..

ISBN 0-88192-693-0..2005..

From the very first page of Judy Glattstein's *Bulbs for Garden Habitats*, it is evident that the author enjoys all things geophytic and has a definite knack for sharing her love through writing. This is one of those rare works that not only provide in-depth information for the novice—it even goes so far as to include a detailed section describing the differences between a true bulb, a corm and a rhizome in addition to an overview of the principal geophyte families—but also provides a great armchair read for more advanced growers.

Rather than falling into the trap of providing an encyclopedic treatment of her favorite bulbs, Glattstein goes one step further and groups many bulbs according to which climates and conditions they are best suited. After all, there is no point in struggling to grow a trumpet daffodil in Texas when a hand-me-down crinum will provide years of delight with almost no effort on the part of the gardener. While this treatment is not as groundbreaking as the publishers claim, *Bulbs for Garden Habitats* packs a surprising amount of information into its 296 pages, with separate chapters dealing with geophytes for temperate woodlands (including an additional chapter on North American natives), Mediterranean climates, Texas, the South and Southeastern USA, waterlogged places and rock gardens.

The appendix provides information about potentially invasive species and includes an impressive list of sources. But perhaps the most interesting part of Glattstein's book is the methodology that was employed in its research. When the author has no first-hand knowledge of a particular habitat, she turns to those who do and thus provides input from many seasoned gardeners from each region in question. Often, however, a mix of personal experience and outside testimony meld together to create a charming hybrid. I dare anyone not to laugh out loud upon reading the hilarious section dedicated to snowdrops (*Galanthus* sp.), no matter what climate they may call home. Furthermore, Glattstein tends not to limit herself exclusively to horticultural experts and publications for some of her information and, when this happens, the result is



fresh, original and thoroughly captivating. A case in point is the fascinating description of *Ismene* (*Hymenocallis*) *amancaes* which was inspired by information received from her brother, Ben Orlove, who had lived in Latin America doing anthropological field research. Not many writers take the time to research how certain geophytes are known and appreciated in their native lands and this particular section provides a thought-provoking glimpse of the impact this yellow-flowered *Ismene* has had on Peruvian culture.

Aside from a few unfortunate editorial problems that result in minor taxonomic inconsistencies throughout several sections of the book, *Bulbs for Garden Habitats* is an engaging and enthusiastic text that is just as much of a good read as it is a good book about bulbs.

Corey Thompson

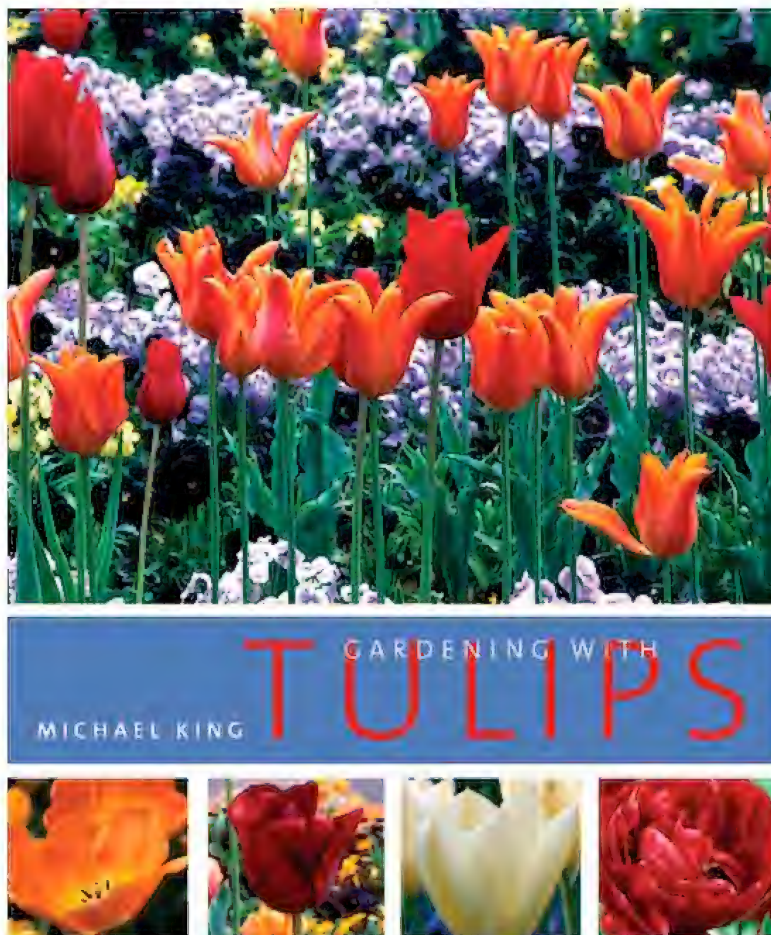
GARDENING WITH TULIPS

Michael King. Timber Press, Inc. Portland, OR. Hardcover, 192 pp, over 470 photos, \$29.95. ISBN 0-88192-744-9. 2005.

Michael King begins *Gardening with Tulips* with a mercifully terse general introduction to the tulip. The next chapter, "Tulips in Contemporary Gardens," is well worth the read for anyone who wants to make effective use of tulips in their garden. *Gardening with Tulips* might have been better titled *Designing with Tulips* because design is the real heart of this book. An avid admirer of tulips, the author has a wonderful array of ideas on the aesthetics of tulips in the garden. While expressing his disdain for the over-use of traditional massive beds of tulips he offers many ideas for how to use tulips in different ways. Bedding-out schemes are not abandoned completely as he readily admits there are places and tulips best suited for that approach, but he does offer some refreshing variations to consider. The latter portion of the chapter discusses his many and imaginative ideas for garden companions for tulips. I admired his observations of how individual tulip selections uniquely connected with the textures, colors, and forms of their companions.

Unfortunately, while many of his design ideas are illustrated, far too many "mug shots" of individual species are used where more informative photographs are needed. Also, as a gardener, I was frustrated by his overly sanguine description of the mechanics of executing his ideas and his rare mention of the unattractive aftermath of the flower display. He gives due deference to the potentially catastrophic disease *Botrytis* (tulip fire) in the back of the book, but makes the questionable claim that gardeners can rely on vigilant rouging to control the disease on perennialized tulips in the small garden.

The final chapter is about the growing of tulips and addresses many of the pertinent cultural questions in a



useful but quick and superficial manner. Another horticultural concern is the book is written for the climate of Amsterdam. The reader is on her own to adapt recommendations to other climates.

"Twenty Classic Tulips" is a chapter devoted to the history and aesthetics of twenty tulip selections, and a host of their close relatives. The individual history of cultivated tulips is a passion of the author's so the book is a good source of brief but fascinating stories of how particular tulips have come to us. The author admits that an interesting history is a sufficient reason for him to grow a tulip. But mostly his discussions are based on aesthetics. His engaging enthusiasm made each and every one of the twenty selections seem like an aesthetic gift from the gods.

A chapter on color continued the aesthetic theme dwelling on the subtle color variations of a long list of tulip selections and how those colors might be utilized in the garden. If you don't think of yourself as a "colorist" you will be overwhelmed.

Gardening with Tulips is a great book on the topic of designing tulips into gardens. I hope buyers don't expect more than that.

Chuck Gleaves

BULBS IN CONTAINERS

Rod Leeds. Photographs by Marie O'Hara. Timber Press, Portland Oregon. 2005. Hardcover. \$29.95. 6" x 9." 103 color photographs, 9 black and white photographs. ISBN 0-88192-735-X.

If I had a potting shed, this is the book I would want to keep on the shelf for quick reference. Rod Leeds shares over 25 years of experience growing bulbs in containers in England.

The book is written in three sections. The first, "A Photographic Year in Containers," is useful because the bulbs are alphabetized according to their blooming season. This makes quick work of figuring out what to plant when.

While experts may be familiar with most of the bulbs in this book, not all of these bulbs are common or easily found. Novices and experienced growers alike will enjoy this comprehensive collection of both familiar and uncommon bulbs that the author feels anyone can grow. There is detailed information on how to care for each bulb, including planting medium, suitable container, proper placement, combinations and what works as well as what does not. It is an excellent reference for a bulb enthusiast who would like to have something in bloom throughout the year.

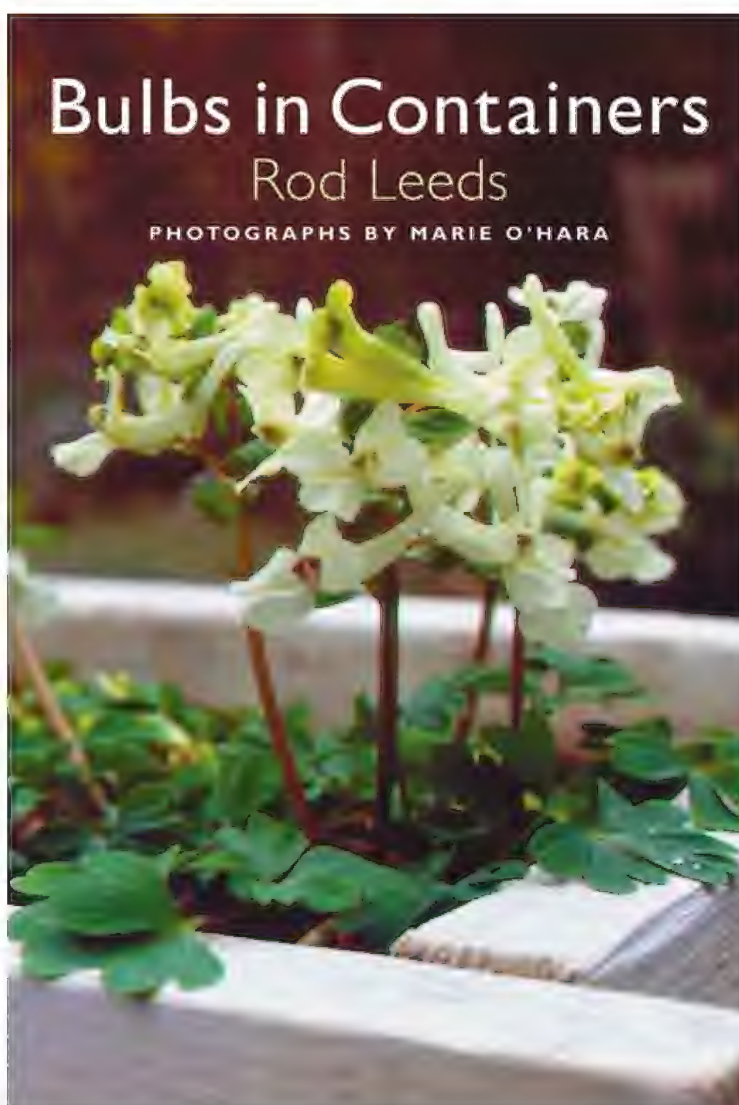
The second section "Bulb Genera Suitable for Containers" discusses more bulbs and has more information allowing you to look up bulbs alphabetically regardless of blooming season. There is information about how the author has successfully grown them and information about how they grow in their natural habitat. Plenty of troubleshooting information is also included. Mr. Leeds shares his knowledge of problems that could occur and how to avoid or treat them. There are instructions on how to build various types of bulb shelters for storing them in the dormant stage, or growing them in climates where they need to be sheltered.

The third section is titled "Practicalities". This section covers environmentally friendly methods of bulb propagation, something the author encourages. There is information on which bulbs set seed easily,

how to collect and store them, viability, germination time and length of time from seed to bloom. Here you will find information on which bulbs can be divided easily and which cannot. Leeds has done a wonderful job of demystifying the process of bulb scaling, bulb chipping, bulb scooping and bulb scoring. The novice can feel confident in following the detailed instructions, with accompanying photographs, when trying any of these methods. This is written like a recipe, no details are left out. There is even a list of equipment to have on hand before you start.

This book is like a perfect garden, there are blooms here for every gardener. From the novice learning about new bulbs to the seasoned gardener who hasn't the time to get out of the dirt and think about which bulb to grow in which season, the answers are here. Following the well thought out and thorough instructions in the book, anyone should be able to have beautiful containers of blooms throughout the year.

Carolyn Craft



xHippeastrelia is facultatively apomictic

By Ben J.M. Zonneveld

ALL PHOTOS BY THE AUTHOR

Two years ago I bought what I thought was a nice fat *Sprekelia* bulb. On flowering it turned out to be a hybrid with *Hippeastrum* (see picture). This was confirmed by its nuclear DNA content. To start with *Sprekelia*, there are at least two types of *S. formosissima* differing in nuclear DNA content and in flower size. Nuclear DNA content is measured in picograms (pg) and 1 pg is ten to the minus 12 gram. For comparison: humans have 7 pg. There is a *S. formosissima* with 148 pg per nucleus that is a tetraploid and *S. formosissima* "Oriental Red" that is hexaploid with 205 pg. Now most of the large ('Dutch') *Hippeastrum* hybrids around are

tetraploids with about 60 pg of DNA per nucleus. As you know, offspring of a cross get half the chromosomes (that is also half the mass of DNA) of the father and half of the mother. So a parent with 20 pg and another with 60 pg per nucleus will give offspring with $10+30 = 40$ pg unless some strange things happen as shown here. So the amount of nuclear DNA I found in my *xHippeastrelia* of 138 pg is nicely in between parents with 62 and 205 pg. This shows that the *S. formosissima* used was the hexaploid form (providing the other parent was a tetraploid *Hippeastrum*).

I crossed the two flowers on my *xHippeastrelia*



with itself and with a large red tetraploid *Hippeastrum* with about 12 (!) flowers per scape. Both crosses were "successful" and did give each about ten seedlings. Of each cross I measured the nuclear DNA content of four seedlings. Surprisingly all had about the same amount of DNA i.e.140 pg and this is the same as the mother plant, the *xHippeastrelia*. This suggests that all 8 seedlings were derived from the mother plant by apomixis. That is to say the pollen probably only stimulated the development of the embryo's but did not contribute any genetic material. At least in the case of the cross with the *Hippeastrum* an intermediate value of about $31 + 69 = 100$ pg would have been expected. I have not seen the flowers as I sowed them this summer but suppose they are all identical to the mother *xHippeastrelia*.

So far so good. This spring the *xHippeastrelia* flowered again. Based on the earlier found apomixis I did not use any hippeastrum pollen but instead used pollen of the hexaploid *Sprekelia*. To my surprise, it turned out that these crosses were successful. That is to say, the hybrids with 169.8, 168.7 and 170.3 pg were intermediate between the two parents with respectively 137 and 205 pg. So it seems that the *xHippeastrelia* is only facultative, apomictic. It cannot be excluded that the use of other hippeastrums will give a different result. I would like to hear from those who have made crosses with *xHippeastrelia*.

Measurements were done by flow cytometry with *Haemanthus albiflos* with 76 pg as internal standard and with propidium iodide as the fluorescent dye. For further details see my articles on nuclear DNA content of all species of *Hosta*, *Galanthus*, *Helleborus*, *Clivia* (in *Herbertia*), *Agapanthus* etc.



TO SUMMARIZE THE DATA:

pg DNA	
<i>Sprekelia formosissima</i>	148
<i>Sprekelia formosissima</i> 'Oriental Red' ----	205
<i>Hippeastrelia</i>	137
Red <i>Hippeastrum</i> used here	62
<i>Hippeastrelia</i> x itself	
No 1	140
No 2	142
No 3	142
No 4	143
<i>Hippeastrelia</i> x red <i>Hippeastrum</i>	
No 1	138
No 2	142
No 3	143
No 4	145
<i>Hippeastrelia</i> x <i>Sprekelia</i> 'Oriental Red'	
No 1	170
No 2	169
No 3	170

Guidelines for IBS Members . . .

who would like to take part in the online seed and bulb exchanges run so successfully by Herbert Kelly

First let me explain that most of the offerings that IBS provides through its BX & SX, are extremely rare, elusive, and unobtainable anywhere else in the country. Twenty to thirty years ago, these botanical treasures were only available to a select few. We have made it convenient for the amateur, as well as the professional botanist, to obtain these items at one convenient location. Without this service obtaining these treasures would come at a prohibitive cost. Listed below are Guidelines to help you use the IBS BX & SX, successfully.

- 1 DO NOT SEND YOUR DONATION UNTIL YOUR REQUEST HAS BEEN CONFIRMED
- 2 Please send your mailing address with every request. Your phone number would be appreciated also.
- 3 Please send your requests, *with the original subject heading that I've sent to the IBS forum, (for each bx or sx), each time.* Not doing so creates more paper work for me. Send this to me privately, NOT to The IBS Forum.
- 4 All donations must be sent to:

International Bulb Society
PO Box 336
Sanger California 93657-0336

- 1 All IBS MEMBERS PARTICIPATING IN THE BX & SX MUST KEEP THEIR ACCOUNTS PAID IN FULL, EVERY 30 DAYS, OR PRIVILEGES WILL BE SUSPENDED, UNTIL BROUGHT CURRENT.
Payment can be made by Check, Money order or Cashiers check. Master card or Visa can be used, by contacting IBS Treasurer, Pam Kelly, at (559) 324-7676 or pkelly1668@aol.com
- 2 Many of the rare seeds and bulbs offered are in short supply, so unfortunately we cannot supply all wants, each time something is offered. We cannot list bulb and seed availability at convenient times to please everyone - as much as we try – in all Time Zones. Try to keep a watchful eye on the IBS Forum postings as it is first come, first served.
- 3 All material is shipped from us in fresh condition. Once it is delivered to the shipper, it becomes your property. We cannot be responsible for loss or damage. Donations are due once the package is shipped. There are no warranties expressed or implied.
- 4 Please watch IBS forum, to see if a particular BX OR SX is closed, before making your request.
- 5 You must be a paid member of IBS, to participate in any BX OR SX offerings, so make sure your membership is kept up to date.
- 6 Please mark you remittance with the specific BX OR SX number, or numbers, each time, before sending to the IBS TREASURER.
- 7 Please reply to me privately at herbk76@aol.com not to ibsmembers@yahoo.com

If you have any questions, or need help, email me at herbk76@aol.com

Herbert Kelly Jr.
Director IBS BX AND SX

Thank You

To all that donated bulbs and seed in 2005:

Patty Allen
Barbara Ciravolo
Tim Eck
Betsy Feuerstein
Alberto Grossi
Rob Hamilton
Rich Hart
Thad Howard
Herbert Kelly Jr.
Victor Lambou
David Lehmler
Michael Loos

Jerry May
Judy McBride
Alan Meerow
Bill & June Paldi
Kevin Preuss
Troy Ray
Jim Shields
Tony Skittone
Riverbanks Zoo & Garden

Your generosity, and unselfish devotion to The International Bulb Society (IBS), pushed the Bulb Exchange (BX), and the Seed Exchange (SX), to new records in 2005. Because of your donations, we were able to distribute 213 offerings of seed and bulbs, from January 1, 2005 to December 31, 2005. This now stands as the largest annual BX and SX distribution of seed and bulbs in IBS history.

My sincere thanks to all of you for helping me make the IBS BX and SX, such a great success.

Herbert Kelly Jr.

Director IBS BX and SX 2005

The IBS would like to acknowledge the continued generous support of the LEF Foundation in 2005

TELOS RARE BULBS

P. O. Box 4147, Arcata, CA 95518 USA

www.TelosRareBulbs.com

We offer a wide selection of hard-to-find bulbs all grown in our nursery.

**Bulbs of the Western USA
Bulbs from Central & South America
Bulbs of Southern Africa
Bulbs from the rest of the world**

CATALOG FREE

TO IBS AND PBS MEMBERS

We are now exporting



Silverhill Seeds & Books

SOUTH AFRICAN SEED AND BOOK SPECIALISTS

P.O. Box 53108, Kenilworth
7745 Cape Town, South Africa
Tel: +27 21 705 0295 Fax: +27 21 705 7987
e-mail: rachel@silverhillseeds.co.za
Website: www.silverhillseeds.co.za

A catalog of seeds and books of bulbous and cormous plants for the connoisseur.

We source and supply seed of over 400 species of native South African bulbous, cormous and rhizomatous plants from the fynbos, grasslands and mountains, as well as a diverse selection of books.

From Amaryllids to Zantedeschias

See instructions on our website to find our online catalog or contact us for a printed catalog at the email address, fax number or postal address above.

TWO IBS PINS TO CHOOSE!

(So why not buy both?)



IBS has now produced TWO International Bulb Society pins. Both have been produced in a very limited quantity and are destined to become valuable collector's items. Actual size is one inch (25 mm) high x .75 inch (19mm) wide with a tie tack-type back. Number one features *Galanthus nivalis* on a dark blue field (enamel) with "IBS" in gold tone and the whole framed in a gold tone edge surrounding the enamel. The second pin features a photo of *Hippeastrum papilio* with IBS in orange on a maroon background.

"Order one or both!"

\$10.00 each

These beautiful collectors items are available only while supplies last. Hurry! Order now.

NAME:

ADDRESS:

CITY STATE ZIP OR POSTAL CODE

COUNTRY:

QUANTITY ORDERED:

Galanthus nivalis *Hippeastrum papilio* TOTAL

TOTAL ENCLOSED: \$

Send your check, cash, or postal money order made out to:

"International Bulb Society" (US funds only)

to: Dave Lehmiller – IBS PIN OFFER,
3530 Fannin, Beaumont, TX, 77701, USA

International Bulb Society
PO Box 336
Sanger CA 93657
USA

PRSRT
US POSTAGE
PAID
SPENCER-WALKER
PRESS